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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Thirty-third Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
EAST BOSTON, MASS., Jan. 20, 1903.

To the Members: The Thirty-third Annual Meeting of the New England Association of Gas Engineers will be held in Young's Hotel, Boston, Mass., February 18th and 19th. The paper list at present carries the titles of 5 communications, and the Question Box has been well appealed to.

Formal notices will be issued shortly. In the meantime those wishing further information respecting the meeting should address the Secretary, as above.

N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

Tenth Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
ANN ARBOR, MICH., Jan. 12, 1903.

To the Members of the Michigan Gas Association: The tenth annual meeting of the Association will be held in Battle Creek, Mich., on Wednesday and Thursday, February 18 and 19. The headquarters of the Association will be the Post Tavern. Good accommodations are assured to all those who apply in advance.

HENRY W. DOUGLAS,
Secretary.

[OFFICIAL NOTICE.]

Noveity Advertising Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY, DELAWARE, O.,
January 20, 1903.

The Editor of the Novelty Advertising Department, Mr. B. W. Perkins, of South Bend, Ind., desires to announce that his department is now open for contributions, to be presented at the Nineteenth Annual Meeting, which will be held in Cincinnati, March 18th, 19th and 20th.

This department should prove very attractive for the convention. Its success, however, depends largely upon the active co-operation of the members. It is, therefore, earnestly hoped that the fraternity will not be backward in sending advertising schemes to Mr. Perkins.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF WRINKLE DEPARTMENT,
ST. PAUL, MINN., Jan. 17, 1903.

This department earnestly solicits the co-operation of the fraternity for contributions, to be presented at the Nineteenth Annual Meeting of the Association, which is to be held at Cincinnati, March 18th, 19th and 20th.

The Editor will be pleased to receive contributions not later than February, 14th.

E. E. EYSENBACH, Editor.
Care St. Paul Gas Light Company,
St. Paul, Minn.

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FEB. 2 1903
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[Official Notice.]

Wrinkle Department, Western Gas Association.

Western Gas Association,
Office of the Wrinkle Department,
721 Citizens Building, Cleveland, O.

To the Members of the Western Gas Association: The Wrinkle Department is now ready to receive contributions for the 1903 collection, and I would thank you to please send a sketch or description of any new device or method you may have to the above address.

Any sketch, photograph or drawing, accompanied by a written explanation, of a new idea will be gratefully received, and it is hoped that you will comply promptly by favoring us with a contribution.

Respectfully,
W. E. Steinwedell,
Editor Wrinkle Department.

BRIEFLY TOLD.

Personal.—Mr. N. T. Meginniss, Secretary of the Consolidated Gas Company, of Baltimore, Md., resigned that position last week. His successor is Mr. Edgar T. Powers, who will be remembered from his recent connection with the Lincoln (Neb.) Gas and Electric Company as its Manager. The resignation of Mr. Meginniss was the result likely of friction between Mr. Alten S. Miller, the recently appointed General Manager of the Company, who it is well known is one who usually likes to have the road liberally to himself when driving. In any event, Mr. Meginniss does not propose to retire from active business, for after a short vacation he proposes to resume work in connection with gas trading. The Baltimore *American* of recent date, in commenting on his excellent service with the Consolidated Company, among other things had this to say: "Mr. Meginniss' first connection with the gas business dates back to March, 1878, when he entered the service of the Consumers Mutual Gas Light Company as teller. Two years later the Consumers, the Peoples and the Gas Light Company, of Baltimore, consolidated, and Mr. Meginniss became teller of the Consolidated Company, the successor of the three corporations. In 1888 the Consolidated absorbed the Equitable and the Chesapeake Gas Companies, and Mr. Meginniss, who had been Assistant Secretary of the old Consolidated, was appointed Assistant Secretary and Auditor of the new Consolidated Company. Upon the death, in 1892, of Secretary L. R. Smoot, Mr. Meginniss became his successor. The present system of accounts used by the Company was introduced by Mr. Meginniss. Mr. Meginniss was graduated from Washington College, Chestertown, Md., in 1860, and served as record clerk and deputy clerk in the Circuit Court, of Kent, under the late Jesse K. Hines. He obtained a position with the Bank of Commerce in this city in 1870, later became teller of the bank, where he remained until 1878."

Notes.—

At the annual meeting of the Cleveland (O.) Gas Light and Coke Company no change was made in the executive management. During the meeting Secretary Beardslee made a well pointed speech referring to the charges made that the candle power of the gas supplied was under that specified by the governing ordinance. The latter provides that the illuminating power shall not be lower than 17 candles, and the Secretary presented tests from the official gas inspector showing that at no time within two years had the candle power been lower than 17.65 candles. In fact, the maximum was 19 candles, the minimum was 17.65, and the average was 18.60.

In noting last week the formation of the Company to take over and manage the affairs of Mr. Fred. Bredel, a slight error was made. The Company is known as the Fred. Bredel Company, it is capitalized in $35,000, its offices are at 405 Keene street, Milwaukee, and its officers are: President, Fred. Bredel; Vice-President, Wm. O. Vitter; Secretary and Treasurer, O. W. Greenslade.

Messrs. Lindsay & Co., of Chicago, inform us that they have just completed arrangements with the F. W. Boardman Company, 113 Davis street, San Francisco, to represent them on the Pacific Coast. The W. F. Boardman Company succeeds Mr. W. F. Boardman, who for a long time has successfully represented on the Coast several Eastern manufacturers of gas appliances.

Mr. F. H. Shelton informs us that his headquarters and offices have been removed from the Fidelity Building, 112 North Broad street, Philadelphia, to the Pennsylvania Building, 15th and Chestnut streets, in the same city.

Mr. Bradley Stoughton, Instructor of Metallurgy, Columbia University, invites the members of the gas fraternity to attend a lecture on "High Temperature Measurements," to be delivered in Room 309, Havemeyer Hall, in the University, at 8 P.M. of the 11th inst. Mr. Irving Bull, Assistant to the Professor of Metallurgy, will be the lecturer, and his presentation of the subject will be illustrated by lantern slides and demonstrations of the more important pyrometers used in metallurgical processes.

[Prepared for the Journal]

Notes on House Piping.

On page 33, Volume III., "King's Treatise," is found:

"The following are the sizes and lengths of iron, lead or composition tubes to be used, according to the number of lights:

Internal Diameter of Tubing, Inches.	Greatest Length Allowed, Feet.	Greatest Number of Burners Allowed.
⅜	20	3
½	30	6
⅝	40	12
¾	50	20
1	70	35
1¼	100	60
1½	150	100
2	200	200

Tubing, ¼ inch bore, is not allowed to be used under any circumstances."

Just what reasons, if any, led Mr. King, or the person from whom he derived this table, to fix upon the limiting lengths here shown, I do not know, but they have been used since that time by probably every company issuing rules about house piping. In the present standard table of house piping of the American Gas Light Association, shown on page 75, Volume 15, of their proceedings, and here reproduced, these same limiting lengths are adopted. Therefore, as the gas world including gasfitters are accustomed to these lengths, it is good policy to adhere to them, as having over any other arbitrary standards the advantage accruing from long usage.

Table for House Piping

Proposed by Research Committee.

$$Q = 1{,}350\sqrt{\frac{d^5\,p}{\frac{1}{g}\,l}}$$

Loss of pressure assumed 1/10 inch of water for 50 feet of pipe.
d = diameter in inches.
p = pressure in inches of water.
l = length of pipe in feet.
g = specific gravity of gas compared with air.
Q = cubic feet of gas per hour.
"g" assumed to .680.
"d" and "l" assumed. "Q" calculated.

d	l	q	d	l	q
⅜	20	11	1½	150	349
½	30	22	2	200	718
¾	50	60	2½	300	1,253
1	70	127	3	450	1,977
1¼	100	222	4	600	4,059

"Q" is the maximum duty per hour for pipe of the length and diameter given.

No greater length of pipe should be used than is given in the table; *e. g.:* The maximum length of 1 inch pipe allowable under any circumstances is 70 feet, and it should not be expected to carry over 127 cubic feet of gas per hour.

Not only have writers on gas distribution and compilers of house piping rules accepted the lengths given by Mr. King, but also (within the limits of my observation) they have accepted this table in its entire form, occasionally, as did the Research Committee, substituting an exact amount in cubic feet for the less exact computation by burners. From the experience that has fallen to my lot within the last 2 years, in connection with the preparation of rules for house piping, I believe that there is room for improvement in the form of this table, and that it could be modified in such a way to make it of greater benefit to those companies who have not facilities of their own for this work, for in its present shape the table is not clear enough to the average fitter, and it also permits a greater loss of pressure than would be allowable in some cases.

Here are points wherein the Research Committee table seems to lack. To begin with, under the conditions of house piping in actual practice, the only information that either the inspector (employed by the gas company) or the fitter (the man who puts in the piping) has, with regard to the quantity of gas carried by the piping, must be derived from the number of outlets called for, and, therefore, a practical house piping table must be made up in terms of outlets, not of cubic feet of gas per hour. An inspection of many houses, after the fixtures were hung, would probably show that there were between 1½ and 2 burners per outlet. Therefore, to be on the safe side, it is best to assume each outlet as equal to 10 cubic feet per hour. When we begin to translate the figures under "Q" in the Research Committee table into outlets, we see at once that, in order not to be too severe on the fitter, we must take for our limit

that multiple of 10 which is nearest the limit of the table; for instance, 130 feet, or 13 outlets, would be the limit for 1-inch pipe.

Taking the Research Committee table as it now stands, it might be possible for, say, a large exposition building, which would call for the extremes of pipe and consumption allowed for the various sizes from 4 inches to ⅜ inch, to have a drop of pressure of about 4 inches between meter and burner. Of course, it is not likely that such a case would occur, but if it did the gas company would be thrown down by its own table. There certainly are apt to be occasions where large buildings piped under this table might show a loss of about 1 inch. I expect to hear in reply that as the table is based on one-tenth inch drop in 50 feet, the drop in any building will be proportional to the length of the pipe, and in big buildings there is bound to be a bigger drop than in small ones. Of course, the drop in house piping must be some function of the extent of the piping, but I believe a better way exists of limiting the loss than in terms of length solely. The larger the building the greater will be the number of sections of piping (a section being the length between adjacent outlets), and if we construct a table in such a way that the drop per section can never exceed a certain amount, then our drop will be governed by number of sections rather than by length of piping, and in practice it seems easier to class buildings by number of sections instead of by length of house piping. In the particular city I have in mind there are many small houses of about 10 sections. With a table designed for a drop of .4 inch per section, the largest possible drop in these houses will be .4 inch, while with the table of the Research Committee there may be a larger drop; yet, as will be shown, the Research Committee calls for larger pipe in actual practice.

In order to make my meaning clearer, I will show three tables, as follows:

No. I. is that of the Research Committee expanded for convenience of comparison into a form similar to that in which the other two tables are made up.

No. II. is No. I. modified in such a way that the loss per section can never exceed .04 inch. This is done by so limiting the length of any

No. I.—*Research Committee Table Expanded.*

No. of Outlets.	Feet per Hour.	⅜-In. Length in Feet.	Loss in Ins. of Water.	½-in. Length in Feet.	Loss in Ins. of Water.	¾-in. Length in Feet.	Loss in Ins. of Water.	1-in. Length in Feet.	Loss in Ins. of Water.	1¼-In. Length in Feet.	Loss in Ins of Water.	1½-In. Length in Feet.	Loss in Ins. of Water.	2-In Length in Feet.	Loss in Ins. of Water.	2½-In. Length in Feet.	Loss in Ins. of Water.	3-In. Length in Feet.	Loss in Ins. of Water.	4-In. Length in Feet.	Loss in Ins. of Water.
1	10	20	.03	30	.01	50	..	70	..	100	..	150	..	200	..	300	..	450	..	600	..
2	20			30	.05	50	.01	70	..	100	..	150	..	200	..	300	..	450	..	600	..
3	30					50	.02	70	..	100	..	150	..	200	..	300	..	450	..	600	..
4	40					50	.04	70	.01	100	..	150	..	200	..	300		450	..	600	..
5	50					50	.07	70	.02	100	..	150	..	200	..	300	..	450	..	600	..
6	60					50	.10	70	.03	100	.01	150	..	200	..	300	..	450	..	600	..
8	80							70	.05	100	.03	150	.01	200	..	300	..	450	..	600	..
10	100							70	.08	100	.04	150	.02	200	..	300	..	450	..	600	..
13	130							70	.14	100	.07	150	.04	200	.01	300	..	450	..	600	..
15	150									100	.09	150	.05	200	.02	300	..	450	..	600	..
20	200									100	.16	150	.10	200	.03	300	.01	450	.01	600	..
22	220									100	.20	150	.12	200	.04	300	.02	450	.01	600	..
25	250											150	.15	200	.05	300	.02	450	.01	600	..
30	300											150	.21	200	.07	300	.03	450	.02	600	..
35	350											150	.30	200	.09	300	.05	450	.03	600	.01
40	400													200	.12	300	.06	450	.04	600	.01
45	450													200	.16	300	.07	450	.05	600	.01
50	500													200	.19	300	.09	450	.06	600	.02
60	600													200	.27	300	.13	450	.08	500	.03
72	720													200	.40	300	.20	450	.12	600	.04
85	850															300	.27	450	.16	600	.05
100	1,000															300	.38	450	.22	600	.07
125	1,550															300	.60	450	.35	600	.11
150	1,500																	450	.50	600	.16
175	1,750																	450	.69	600	.22
200	2,000																	450	.90	600	.28
225	2,250																			600	.36
250	2,500																			600	.44
300	3,000																			600	.63
350	3,500																			600	1.87
400	4,000																			600	1.20

No. II.—*Research Committee Table Modified.*

No. of Outlets.	Feet per Hour.	⅜-In. Length in Feet	Loss in Ins. of Water.	½-In. Length in Feet.	Loss in Ins. of Water.	¾-In. Length in Feet.	Loss in Ins. of Water.	1-In. Length in Feet.	Loss in Ins. of Water.	1¼-In. Length in Feet.	Loss in Ins of Water.	1½-In. Length in Feet.	Loss in Ins. of Water.	2 In. Length in Feet.	Loss in Ins. of Water.	2½-In. Length in Feet	Loss in Ins. of Water.	3-In. Length in Feet.	Loss in Ins. of Water.	4-In. Length in Feet.	Loss in Ins. of Water.
1	10	20	.03	30	.01	50	..	70	..	100	..	150	..	200	..	300	..	450	..	600	..
2	20			25	.04	50	.01	70	..	100	..	150	..	200	..	300	..	450	..	600	..
3	30					50	.02	70	..	100	..	150	..	200	..	300	..	450	..	600	..
4	40					50	.04	70	.01	100	..	150	..	200	..	300	..	450	..	600	..
5	50					32	.04	70	.02	100	.01	150	..	200	..	300	..	450	..	600	..
6	60					22	.04	70	.03	100	.02	150	..	200	..	300	..	450	..	600	..
8	80							53	.04	100	.03	150	.01	200	..	300	..	450	..	600	..
10	100							33	.04	100	.04	150	.02	200	..	300	..	450	..	600	..
13	130							19	.04	60	.04	147	.04	200	.01	300	..	450	..	600	..
15	150									45	.04	112	.04	200	.02	300	..	450	..	600	..
20	200									25	.04	65	.04	200	.03	300	.01	450	.01	600	..
22	220									21	.04	52	.04	200	.04	300	.02	450	.01	600	..
25	250											41	.04	170	.04	300	.02	450	.01	600	..
30	300											28	.04	120	.04	300	.03	450	.02	600	..
35	350											21	.04	87	.04	265	.04	450	.03	600	.01
40	400													68	.04	205	.04	450	.04	600	.01
45	450													54	.04	160	.04	400	.04	600	.01
50	500													43	.04	132	.04	320	.04	600	.02
60	600													30	.04	95	.04	235	.04	600	.03
72	720													21	.01	60	.04	160	.04	600	.04
85	850															47	.04	112	.04	480	.04
100	1,000															33	.04	80	.04	335	.04
125	1,250															21	.04	53	.04	220	.04
150	1,500																	37	.04	155	.04
175	1,750																	28	.04	112	.04
200	2,000																	21	.04	87	.04
225	2,250																			68	.04
250	2,500																			59	.04
300	3,000																			39	.04
360	3,500																			26	.04
400	4,000																			22	.04

No. III.—*Table Used in City of .....*

No. of Outlets.	Feet per Hour.	⅜-In. Length in Feet.	Loss in Ins. of Water.	½-In. Length in Feet	Loss in Ins. of Water.	¾-In. Length in Feet.	Loss. in Ins. of Water.	1-In. Length in Feet.	Loss in Ins. of Water.	1¼-In. Length in Feet.	Loss in Ins. of Water.	1½-In. Length in Feet.	Loss in Ins. of Water.	2-In. Length in Feet.	Loss in Ins. of Water.	2½-In. Length in Feet.	Loss in Ins. of Water.	3-In. Length in Feet.	Loss in Ins. of Water.	4-In. Length in Feet.	Loss in Ins. of Water.
1	10	20	.03	30	.01	50	..	70	..	100	..	150	..	200	..	300	..	400	..	600	..
2	20			27	.04	50	.01	70	..	100	..	150	..	200	..	300	..	400	..	600	..
3	30			12	.04	50	.02	70	..	100	..	150	..	200	..	300	..	400	..	600	..
4	40					50	.04	70	.01	100	..	150	..	200	..	300	..	400	..	600	..
5	50					33	.04	70	.02	100	.01	150	..	200	..	300	..	400	..	600	..
6	60					24	.04	70	.03	100	.01	150	..	200	..	300	..	400	..	600	..
8	80					13	.04	50	.04	100	.02	150	.01	200	..	300	..	400	..	600	..
10	100							35	.04	100	.04	150	.02	200	..	300	..	400	..	600	..
13	130							21	.04	60	.04	150	.04	200	.01	300	..	400	..	600	..
15	150							16	.04	45	.04	120	.04	200	.02	300	..	400	..	600	..
20	200									27	.04	85	.04	200	.03	300	.01	400	..	600	..
25	250									17	.04	42	.04	175	.04	300	.02	400	.01	600	..
30	300									12	.04	30	.04	120	.04	300	.03	400	.02	600	..
35	350											22	.04	90	.04	270	.04	400	.02	600	.01
40	400											17	.04	70	.04	210	.04	400	.03	600	.01
45	450											13	.04	55	.04	165	.04	400	.04	600	.01
50	500													45	.04	135	.04	330	.04	600	.02
65	650													27	.04	80	.04	200	.04	600	.03
75	750													20	.04	60	.04	150	.04	600	.04
100	1,000															33	.04	80	.04	360	.04
125	1,250															22	.04	50	.04	230	.04
150	1,500															15	.04	35	.04	160	.04
175	1,750																	28	.04	120	.04
200	2,000																	21	.04	90	.04
225	2,250																	17	.04	70	.04
250	2,500																	14	.04	59	.04
300	3,000																			39	.04
350	3,500																			29	.04
400	4,000																			22	.04
450	4,500																			18	.04
500	5,000																			14	.04
550	5,500																			12	.04

This table is based on the limiting lengths given in "King's Treatise," and the loss of pressures limited to one-tenth of an inch in 30 feet. The constant 1,350, with specific gravity of .65 was used on a Cox computer.

size pipe for varying number of outlets to such an extent that the drop in any section never exceeds .04 inch.

No. III. is the table[1] in use in the particular city, which the exception of 3 inches accepts the limiting lengths of the Research Committee. The loss per section is also limited to .04 inch, but instead of working with a drop of one-tenth inch in 50 feet, the old time standard of one-tenth inch in 30 feet is used.

Tables No. I. and II. were prepared by the aid of a Cox's computer, using the constants of the Research Committee, the distances on the computer being extended down to one yard and the sizes of pipes to ⅛ inch. The pressures as shown are probably in error .001 or .002.

A comparison of these three tables shows that No. III. allows more outlets for any given size of pipe than I. or II. For convenience this difference is indicated in tabular form.

Size Pipe.	Number of Outlets. Table No. III.	Tables Nos. I. and II.
¾-inch.	1	1
1 "	3	2
1¼ "	8	6
1 "	15	13
1½ "	30	22
1¾ "	45	35
2 "	75	72
2½ "	150	125
3 "	250	200
4 "	550	400

The result of this difference in the ½-inch, ¾-inch and 1-inch sizes is to enable the fitter to use pipe of smaller size when working under table No. III. than would be required by tables Nos. I. and II. Notwithscanding this, the effect of reducing the lengths allowable as the number of outlets increase, is to make piping under table No. III. work out in actual practice, with not much more drop than if run under tables Nos. I. and II., while there is no danger of excessive drops being allowed, as could take place under table No. I.

In order to compare the workings of these three tables I took some representative house piping plans, and worked out the size of pipe that, for the lengths and outlets given, would be required by the different tables, and the drop in pressure in the sections taken, forming a continuous line from the farthest outlet to the meter. The results are shown in the figures headed Plans A, B, C and D.

1. The form of this table is taken by the writer from a table prepared for the United Gas Improvement Company by Mr. W. J. Serrill.

PLAN "A."

	Size of Pipe Tables.				*Loss of Pressure Tables.*		
Outlets.	Feet and Inches.	No. 1. Inches.	No. 2. Inches.	No. 3. Inches.	No. 1.	No. 2.	No. 3.
1	20 7	½	½	½	.008	.008	.008
2	4 2	½	½	½	.007	.007	.007
3	2 7	¾	¾	½	.004	.004	.009
5	2 11	¾	¾	¾	.006	.006	.066
6	6 4	¾	¾	¾	.011	.011	.011
7	8 8	1	1	¾	.006	.006	.020
8	2 7	1	1	¾	.004	.004	.008
9	2 9	1	1	1	.005	.005	.005
10	25 0	1	1	1	.028	.028	.028
	75 7				.079	.079	.102

PLAN "B."

	Size of Pipe Tables.				*Loss of Pressure Tables.*		
Outlets.	Feet and Inches.	No. 1. Inches.	No. 2. Inches	No. 3 Inches	No. 1.	No. 2.	No. 3.
1	11 6½	⅜	⅜	⅜	.017	.017	.017
2	11 6½	½	½	½	.017	.017	.017
3	11 6½	¾	¾	½	.005	.005	.038
4	11 6½	¾	¾	¾	.009	.009	.009
5	9 ½	¾	¾	¾	.011	.011	.011
8	2 0	1	1	¾	.004	.004	.007
9	4 3	1	1	1	.006	.006	.006
10	4 1½	1	1	1	.007	.007	.007
11	2 1	1	1	1	.005	.005	.005
16	3 5	1¼	1¼	1¼	.004	.004	.004
17	2 7	1¼	1¼	1¼	.00	.004	.004
18	7 3	1¼	1¼	1¼	.009	.009	.009
19	0 8	1¼	1¼	1¼	.003	.003	.003
20	5 2	1¼	1¼	1¼	.008	.008	.008
	86 8¾				.109	.109	.145

PLAN "C."

	Size of Pipe Tables.				*Loss of Pressure Tables.*		
Outlets.	Feet and Inches.	No. 1. Inches.	No. 2. Inches.	No. 3. Inches.	No. 1.	No. 2	No. 3.
1	7 0	⅜	⅜	⅜	.011	.011	0.11
2	9 2	½	½	½	.013	.013	0.13
4	9 10	¾	¾	¾	.008	.008	.008
5	11 3	¾	¾	¾	.013	.013	.013
10	8 8	1	1	1	.010	.010	.010
17	11 0	1¼	1¼	1¼	.010	.010	.010
20	4 4	1¼	1¼	1¼	.008	.008	.008
	61 3				.073	.073	.073

PLAN "D."

	Size of Pipe Tables.				*Loss of Pressure Tables.*		
Outlets.	Feet and Inches.	No. I. Inches.	No. 2. Inches.	No. 3. Inches	No. 1.	No. 2.	No. 3.
1	7 0	⅜	⅜	⅜	.011	.011	.011
2	9 3	½	½	½	.013	.013	.013
3	8 6	¾	¾	½	.005	.005	.028
5	7 0	¾	¾	¾	.008	.008	.008
6	3 1	¾	¾	¾	.005	.005	.005
8	8 6	1	1	¾	.009	.009	.040
23	8 6	1½	1½	1½	.007	.007	.016
27	1 6	1½	1½	1½	.004	.004	.006
45	8 6	2	2	1½	.007	.007	.025
49	1 6	2	2	2	.003	.003	.003
68	8 6	2	2	2	.013	.013	.013
72	1 6	2	2	2	.004	.004	.004
90	8 6	2½	2½	2½	.008	.008	.008
94	1 6	2½	2½	2½	.003	.003	.003
112	8 6	2½	2½	2½	.012	.012	.012
116	1 6	2½	2½	2½	.004	.004	.004
134	8 6	3	3	2½	.008	.008	.017
154	14 0	3	3	3	.015	.015	.015
180	1 0	3	3	3	.004	.004	.004
203	9 2	4	4	3	.006	.006	.017
205	15 8	4	4	3	.008	.008	.030
209	32 3	4	4	4	.016	.016	.016
448	8 6	6	6	4	.004	.004	.016
	182 3				.177	.177	.314

In each case the figures in the first column indicate the number of outlets supplied by the sections of piping whose length is given in the second column, and the other columns show the size of pipe required by the various tables and the loss of pressure in that section, when delivering gas at the rate of 10 feet per hour for each outlet. Plan "A" is of a house that rents for $15 a month, of which many thousand are built in our city every year. Plans "B" and "C" are of larger houses, renting from $35 to $50, while Plan "D" is from a very large apartment house.

For all 4 plans the requirements of tables No. I. and No. II. proved to be identical, the lengths of all sections being short enough not to be affected by the limits imposed by table No. II. If I had been able to secure a plan of the piping in the buildings of a recent Exposition, it is probable that the limiting lengths of table No. II. would have made the piping in some cases one size larger than called for by table No. I., and in this way avoided undue drop in pressure.

In none of the 4 plans is the drop allowed by table No. III. too much, and yet under the latter table in several cases smaller pipe is permitted than by tables Nos. I. and II. Plan "D" illustrates very well the unnecessary rigor of tables Nos. I. and II. Under table No. III. no 6-inch at all is required and much less 4-inch, and yet on a basis of hourly consumption (10 feet per outlet) much higher than would obtain; in fact, the loss of pressure under table No. III. is but .3 inches

To conclude, I think that table No. I. is not drawn up in the best way to fit into actual practice, and that if its requirements are to be lived up to it should be modified into table No. II., to prevent any excessive drop in buildings of large extent, but preferably to this I believe that a more liberal table such as No. III. will meet all the purposes for which No. I. is designed, and will have the advantage of not requiring the use of as large pipe in many cases.

Lighting of Factories and Workshops.[1]

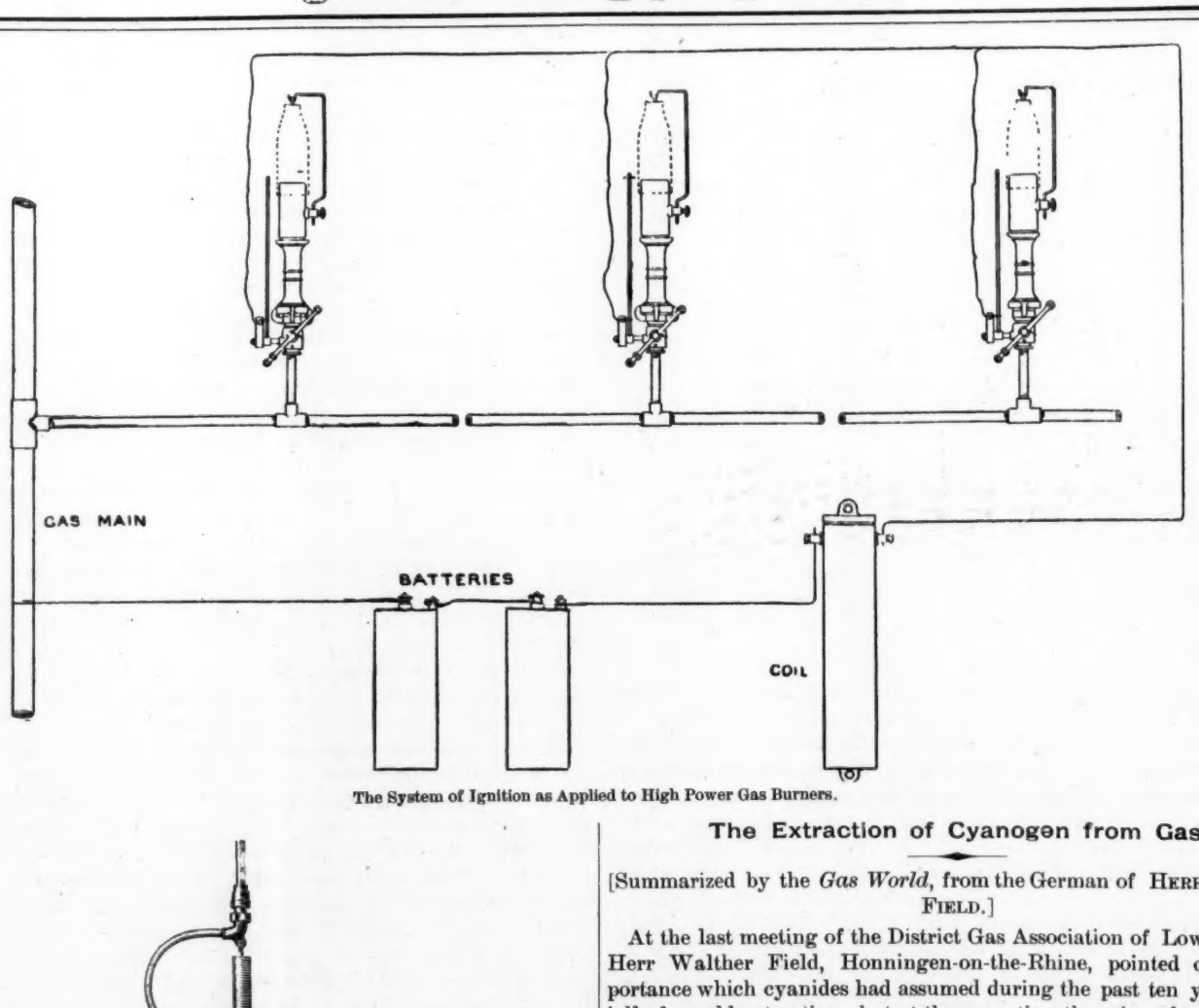
Attention has recently been drawn to the attitude of insurance companies towards the use of incandescent lights in textile factories; and this affects high as well as low pressure incandescent lighting. The opposition of the insurance people, as marked by the increased premiums they charge on factories lighted by such means, is a matter in which a large and important section of the gas industry is concerned, and therefore a matter upon which all information that will assist in enabling them to meet the objections will be welcome. One of the chief of these is the use of bye-pass or pilot lights; and, in this connection, it is a satisfaction to find that the Fire Offices Committee are open to the consideration of reasonable substitutes for the constantly burning igniting jet. This is shown by the fact that they have been satisfied by the James Keith and Blackman Company, Limited, as to the absolute safety in such establishments of a simple system of ignition by electrical means which they have patented; and the Committee have modified their rules to admit of its employment, without the extra premium hitherto charged where bye-pass or pilot lights are used. This concession is alone a valuable testimony to the performance of the arrangement, which is ingenious, of extremely simple parts, and can be adapted to any ordinary or high pressure incandescent burner.

The fittings merely comprise a modest little device for each burner, a battery of two or three ordinary dry cells, and a single wire running round the premises, with a branch wire to each burner. One pole of the battery is connected to the main gas pipe, and the other pole to an insulated wire, from which the branch wires are run. At some convenient point in the installation, the insulated wire is connected to a plain coil of wire neatly incased, which intensifies the spark. The illustration shows the simplicity of the device fitted to the burner. There is a vertical bye-pass tube carried on an arm leading from the side of the burner parallel with the cock-lever when in a horizontal position. On the end of this arm, and at the base of the bye-pass rod, is fixed an insulated block, from which protrudes a small curved wire. Then, on the inside of the lever of the cock, is also a small arm carrying a spiral wire. This wire represents one pole of the battery; and the wire fixed to the insulated block, the other pole. Now starting with both cock and bye-pass off, to use the lighter, the right hand chain is pulled down until the lever cock reaches the end of its full travel. During this movement, the terminal wires come into rubbing contact with each other; and, on breaking contact, a spark is formed, which ignites the gas that has obtained passage to the bye-pass tube during the movement of the cock. The tube is perforated with about twelve pin holes. The bottom jet ignites, and the others follow suit in rapid succession, after the manner of the climbing type of igniters for street-lamps that were introduced some time since. In the case of this electrical igniter, however, there is nothing ugly about the fitting; the bye-pass tube being only of ordinary dimmensions suitable to the type of burner to which it is attached. The perforations in the tube are so made that the uppermost jet is at right angles with the bottom one, and thus it impinges direct on the mantle, and lights the burner. What has been described is all that is required and that takes place to bring about ignition; but there is one other little point to be explained. On pulling down the chain to operate the cock-lever, a strong spring, securely fixed round the external portion of the plug of the cock, comes into contact with a peg in the body of the burner; and, on the chain being released, this brings the plug back so that the gas-way to the burner is fully open—thus shutting off the bye-pass, and holding the electric contacts well apart. There is no possibility of running the batteries down through carelessness or by contact being continued; the spring absolutely preventing such a contingency. By its operation, too, the bye-pass is always shut off after it has accomplished its object; and so the gas consumed by it is infinitesimal—only a momentary passing of gas being required to light the burner.

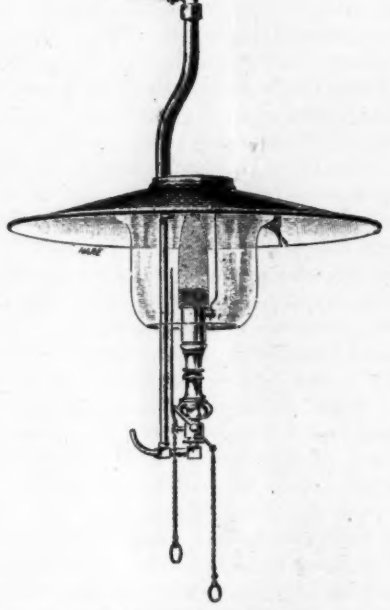
In places where this method of ignition is applied, there are no pilot lights going during the time the works are closed, or during the day; and the gas may be completely shut off when closing the premises for the night, which is impossible where pilot lights are burning. So it is seen the main objection to the use of gas (and incandescent lights in particular) and matches in textile or other factories is wholly surmounted in an easy, cheap, and absolutely safe manner. The details of this ingenious device have been well thought out; it is a substantial little thing; and the question of maintenance is one that can be of only periodical concern, and a comparatively inexpensive matter. An opportunity has been afforded for testing a number of these devices, and in every case their action was certain and perfect.

In conjunction with the above system of ignition, we may briefly describe a form of reflector pendant lamp which the same firm have produced for the lighting of factories and workshops. and in which they have given special attention to the requirements of such establishments. The lamp is a neat fitting, with ample reflector for the downward distribution of the light. The illustration (p. 166) is not the newest type of the lamp, but it serves the purpose of conveying the principal points. It shows the style of lamp that has been very successful; and the improved form should be found even more so. The lamp is simply suspended by a hook from a spring anti-vibrator, and the gas is conveyed to the supply pipe by a piece of flexible tubing. The reflector in the new form is surmounted by a cowl, which disperses the heated products of combustion laterally, instead of permitting a constant direct upward current. The lamp is also fitted with a special shaped, flanged globe, which is suspended from the reflector (which is recessed for its reception) by a simple trigger arrangement. When cleaning the lamp, the globe is simply slipped down, and rests on the hook shown at the bottom of the fitting. The serviceable appearance of the lamp is very pleasing.

1. *Journal of Gas Lighting*.



The System of Ignition as Applied to High Power Gas Burners.



The Factory Reflector Pendant.

A small improvement has been effected in the Company's burners by which the noise of, which complaint is made in connection with the high-pressure system, has been considerbly reduced. The improvement is simply a special form of nipple; but its use is not recommended in positions where a little noise is not objectionable. It will be found very useful in such places as churches and halls.

At the annual meeting of the Evansville (Ind.) Gas and Electric Light Company the officers elected were: Directors, Jno. Farson, Edward B. Lewis, Francis J. Reitz, Geo. G. Olmsted, Robert K. Dunkerson, A. W. Howard and Chas. F. Heilman; President, E. B. Lewis; Treasurer, Henry Reis; Secretary, Jas. F. Foster.

The Extraction of Cyanogen from Gas.

[Summarized by the *Gas World*, from the German of Herr Walther Field.]

At the last meeting of the District Gas Association of Lower Saxony, Herr Walther Field, Honningen-on-the-Rhine, pointed out the importance which cyanides had assumed during the past ten years, especially for gold extraction; but at the same time the prices obtainable have gone down. Gas has not been able to furnish the needed supplies, so that various synthetic methods have been introduced, in which the cyanogen is derived from ammonia or from nitrogenous products, or from the nitrogen of the air.

The average amount of cyanogen in gas, measured after condensation and before washing for ammonia, is from 0.926 to 1.431 grains per cubic foot in German works, 0.989 in English, and 0.951 in French works. This would correspond to about 1.65 pounds of cyanogen (CN) per ton of coal. The annual demand for cyanides corresponds to about 10,000 tons of potassium cyanide (4,000 tons CN), which could be obtained from the distillation of about 6,000,000 tons of coal, so that the gas industry could easily meet all the requirements. That it has not done so must be due (1) to the recovery being expensive, (2) to the cyanogen being recovered in an unsuitable form, or (3) to imperfections in the methods of recovery. The first of these causes is certainly not operative; but the price obtainable for the Prussian blue recovered corresponds only to 15 or 20 per cent. of the price of cyanogen in the form of KCN. The potash necessary to make KCN costs about an equal percentage on the price of KCN.

The question for the gas works then is, in what form should cyanogen be recovered so as to put the gas works in the most favorable position? The older method is to take what comes in the purifying mass, the the quantity thus recovered being, as it were, left to chance. Newer methods have not come much into use, apparently because their results fall short of expectations. Almost all these methods depend upon the formation of iron cyanogen compounds, which are very readily formed, and are, in alkaline and neutral conditions, exceeded in stability only by cyanide of mercury, while in presence of H_2S or acids they are more stable than this. Their production is favored by the presence of alkalies; but de Vigne, who advocated the addition of alkali to iron oxide in 1884, went too far, and recommended a useless excess of alkali, under the idea that this promoted absorption. In 1888 Knublauch took the right course and used a liquid, with alkali and iron oxide dissolved or suspended in it; and many modifications of this have been introduced. But there was a fundamental misconception as to the nature of the process, and Leybold first showed, in 1893, that the gas must travel extremely slowly through purifiers and must be previously freed from ammonia. Attention to these points so greatly raised the percentage of cyanogen recovered

in iron oxide purifiers that methods based upon passing the gas through liquids fell into the background. Percentages of 2 or 4 of Prussian blue in the iron oxide were at once raised to 10 or 12, and the cyanogen recovered rose from 40 to 75 per cent. of the whole. For small works this is about the highest efficiency remuneratively attainable; but the form of the product is bad, on account of its bulkiness and of the presence of sulphur. Where, say, over a million tons of coal are distilled per annum, it is of great consequencc that the separation of sulphur and that of cyanogea should be made independent of one another.

The most advantageous form in which to recover cyanogen would be that of soluble ferrocyanides. Knublauch aimed at this, but got only 80 per cent. of the cyanogen in that form, with 20 per cent. in insoluble compounds. A mixture of this kind is more troublesome than one which is wholly insoluble; so the Knublauch process has been modified with the view of producing Prussian blue instead.

Nature of the Process.—Ferric hydrate at first does not absorb HCN; but when reduced by H_2S to ferrous hydrate (with separation of sulphur) it begins to absorb, forming $FeCy_2$ (Berlin white). At the same time ferric and ferrous hydrates can act together, forming Prussian blue; $4Fe_2(OH)_6 + 6Fe(OH)_2 + 36HCy = 2Fe_7Cy_{18} + 36\ H_2O$. When FeS is formed, as in the reaction $Fe(OH)_2 + H_2S = FeS + 2H_2O$, it is generally held that it cannot absorb HCy; but it can do so, though slowly, in presence of oxygen; $O + FeS + 2\ HCy = FeCy_2 + H_2O + S$; and a mixture of FeS and $Fe_2(OH)_6$ can do the same thing. As the percentage of FeS increases, the absorption becomes slower. The $FeCy_2$ in the purifying material is converted into Prussian blue during the regeneration of the mass. Regenerated material contains both ferrous and ferric hydrates, and can begin to absorb HCy at once.

In the Knublauch processes the importance of not beginning with ferric hydrates has been lost sight of. Mr. Foulis, for instance, uses freshly precipitated ferrous hydrate, well washed, and mixed with carbonate of soda; but this oxidizes, and the resultant mixture of ferric and ferrous hydrates promptly forms about 20 per cent. of Prussian blue along with about 80 per cent. of ferrocyanide of sodium; $4Fe(OH)_2 + 2Fe_2(OH)_6 + 2Na_2CO_3 + 24HCN = Fe_7Cy_{18} + Na_4FeCy_6 + 2Co_2 + 22H_2O$. In order to prevent the formation of Prussian blue, we must therefore make our precipitates of ferrous hydrate away from the action of air, say, under an atmosphere of coal gas. If this be attended to, with sufficient excess of carbonate of soda, we have nothing but soluble sodium ferrocyanide; $Fe(OH_2) + 2Na_2CO_3 + 6HCN = Na_4FeCy_6 + 4H_2O + 2CO_2$. If there be not a sufficient excess of carbonate of soda, insoluble Berlin white will be formed. The whole reaction will be $FeSO_4 + 3Na_2CO_3 + 6HCN = Na_4FeCy_6 + Na_2SO_4 + 3H_2O + CO_2$; so that there must be at least three equivalents of carbonate of soda mixed with one of sulphate of iron, one to precipitate ferrous hydrate and two to co-operate with this ferrous hydrate in absorbing HCN, and a trifle over to insure an alkaline condition and prevent the formation of insoluble compounds. If the sulphate of iron is at all rusty there will be a corresponding quantity of Prussian blue formed. The accuracy of the preceding is easy to demonstrate by laboratory experiments.

There are some secondary reactions. If milk of lime be mixed with the iron sulphate solution we have carbonate and sulphydrate of calcium produced, but these again tend to form cyanide of calcium; and cyanide of calcium with ferrous sulphide forms ferrocyanide of calcium and CaSHOH. Carbonic acid in the gas tends, however, to complicate matters by taking up the base.

Working Rules for Soluble Products.—Bring the ferrous solution and the soda or lime into the washer separately; mix them in the washer, not outside, so that no air may reach the precipitate. Change the absorbent in small portions at a time, not all at once. Use milk of lime or carbonate of soda, since these do not appreciably affect FeS, and thus do not favor the formation of sulphocyanides or other soluble sulphur compounds. Use lime rather than soda, and use sulphate of iron solution; the resultant ferrocyanide of calcium solution is then nearly pure, for sulphate of lime is nearly insoluble, while sulphate of soda is soluble. This advantage outweighs the comparative slowness and bulkiness of lime. Besides, ferrocyanide of calcium can be used directly for making KCy, NaCy, K_4FeCy_6, Na_4FeCy_6, etc., while the ferrocyanide of sodium can merely be purified or converted into NaCy; and the calcium salt has, therefore, actually a higher market value.

Insoluble Cyanogen Compounds.—The gas works may sometimes find that there is more demand for insoluble compounds than for soluble; but in this case uniformity of product and a high percentage of cyanogen are again desirable. Here again we must keep clear of ferric salts, since these promote the separation of sulphur. The quantity of alkali has, however, to be limited; $FeSO_4 + Na_2CO_3 + H_2O = Na_2SO_4 + Fe(OH)_2 + CO_2$; the quantity of soda being then no more than is required in order to precipitate the ferrous hydrate. The washer must be capacious, so that there may always be fresh material acting npon the gas; otherwise the ferrous hydrate would soon be converted into ferrous sulphide, and the absorbent must be added in small portions at a time.

Losses of Cyanogen.—(1) Through formation of carbonyl ferrocyanide. This is small and practically negligible. (2) Through formation of sulphocyanides. This loss sometimes goes up as high as 60 per cent., or even more. Dr. Leybold showed that it is directly due to the presence of ammonia in the purifying material, pure ammonia causing the loss of about a half where a corresponding quantity of sulphide of ammonium caused the loss of one-third of the cyanogen. Even if neutralized by sulphate of iron the presence of ammonia caused a loss equal to that caused by sulphide of ammonium.

The reason of this is that the sulphur is deposited in a nascent condition, and nascent $(NH_4)_2S$, from NH_4Cy and FeS, combines with it to form $(NH_4)_2S_2$. The ammonia, in the form of cyanide for a moment, meets this and forms sulphocyanide; $2NH_4Cy + (NH_4)_2S_2 = 2(NH_4CNS) + NH_4)_2S$. In gas we have, however, not $(NH_4)_2S$, but NH_4HS; and then we have $2(NH_4)HS + Fe_2(OH)_6 = 2Fe(OH)_2 + NH_4)_2S + S + 2H_2O$; $(NH_4)_2S + S = (NH_4)_2S_2$; and $(NH_4)_2S_2 + HCN = NH_4HS + NH_4CNS$, sulphocyanide of ammonium. The formation of sulphocyanide is thus due to the presence of ferric oxide, which causes the separation of sulphur. But there is also another cause, the presence of oxygen; $2(NH_4)HS + O = (NH_4)_2S + H_2O + S$ (sulphur separated); then $(NH_4)_2S + S_2 = (NH_4)_2S_3$; and $(NH_4)_2S_3 + HCN + O = 2NH_4CNS + H_2O + S$. The proportion of oxygen in gas being small this plays a subordinate part in gas works, but is very important in coke ovens.

When the ammonia in the purifying mass is neutralized by sulphate of iron, there seems to be several simultaneous processes. Iron oxide and H_2S form ferrous oxide and sulphur. Oxygen and H_2S react upon one another with some vigor in the presence of iron compounds; ferrous sulphate becomes ferric sulphate and ferrous sulphide, which break up into ferrous sulphate and sulphur, the result being as if $O + H_2S = H_2O + S$. The ammonia in the gas is preponderantly in the form of NH_4HS and ammonium carbonate, and converts the iron salt into ferrous sulphide. This acts upon hydrocyanic acid and $(NH_4)_2S$ to form sulphocyanide of ammonium, just as when sulphide of ammonium was present.

In the ammonia washers there is very little sulphocyanide formed; the gases are too dilute, but what there is is due to the presence of sulphide of iron and free sulphur on the walls of the washer. The ammonia washing should therefore be finished before the gas meets iron compounds, particularly if the gas contains oxygen. Once the ammonia has gone, the presence of oxygen does no harm to the yield in cyanogen; but so long as ammonia is present, the loss of cyanogen in the useless form of sulphocyanides is proportional to the quantity of oxygen in the gas.

This all-importance of getting the gas completely freed from ammonia or ammonium compounds before it is admitted to the washer containing precipitated ferrous hydrate is equally urgent whether the object in view be the production of soluble ferrocyanides or of insoluble Prussian blue.

Coking in Bee-Hive Ovens with Reference to Yield.

By Mr. Charles Catlett, M.E.

My attention having been called several years ago to the possibility of increasing the yield of coke per ton of coal, as obtained in certain bee-hive ovens, I called the attention of the Institute to the matter at the New York meeting in 1899. I have had occasion since to witness the indifference with which this matter is ordinarily considered, and, on the other hand, the marked improvement which comes from even a most perfunctory effort in that direction; and I am almost tempted to say that nothing in connection with the coking of coal is at present so important. There are other factors, which are fundamental and necessary; but they have been considered already; while the question of yield is, as a rule, absolutely ignored, or some figure is taken as the result of a special burning of one or two ovens, and the assumption is made that the whole battery is yielding at that rate. The uncertainty of this assumption I may illustrate by saying that, in my own observation, the burning of a single oven in a battery frequently gives, by actual weight, as much as 69 or 70 per cent. of merchantable coke while the battery as a whole was yielding only an average of 63 per cent.

Only from careful records, checked at least once a month, of the weight of the coal going to the ovens and the weight of coke produced, can any correct idea of the actual yield be gained, or methods be modified so as to produce good results; yet, as a rule, the crudest estimates are usually the only available data. In many cases there are reasons for this loose practice. The coal is mined by measurement; the payment for drawing the ovens is in proportion to the amount of coal which goes to them; and, not uncommonly, the royalty is so much a ton of coke, not of coal. The mine manager is tempted to increase the volume of coal mined which is paid for as a ton, and to do the same thing in charging the ovens. Nor does he wish the royalty charge to be changed in any way. The result is that often his records do not truly show within quite a large percentage the actual weight of coal mined and charged in his ovens. Yet until he has accurate information on this point, he cannot tell what is the amount of loss under present methods, or how to improve on them. I venture the assertion that the owners of many plants in the Connellsville region, otherwise well managed, who complacently accept Mr. Fulton's statement that the yield of the Connellsville coal in coke is 66 per cent., would be astonished should they ascertain what is their actual yield.

The effect of a slight increase in the yield per cent. is greater than is usually realized. For instance, if a battery of ovens is yielding 60 per cent. and the yield is increased to 61 per cent., there has been an absolute saving of one-sixtieth, or 1.66 per cent. of the total value of the coke formerly produced, less the cost of loading—since all the other expenses remain the same. I have never yet examined a battery of ovens, where the attention of the management had not been called to the yield, in which it was not possible to make an increase of from 3 to 5 per cent. If, for purposes of illustration, we assume that the former yield was 60 per cent. (which figure does not vary greatly from the general practice), the saving of 3 per cent. would mean a total saving of $\frac{1}{20}$th of the output, and a having of 5 per cent. would mean a total saving of $\frac{1}{12}$th of the output. Enormous as this difference may seem, it is exceedingly common, and at times is greatly exceeded. I know of a coking district which, as a whole, is only yielding 55 or 56 per cent., though the coal could readily be made to yield from 65 to 70 per cent.

The loss of the by-products in the 63,000 bee-hive coke ovens in this country is an appalling waste of natural supplies, and has been a fruitful source of discussion as to the wastefulness of our methods If, however, I am right in my belief that my own experience fairly represents the conditions at the majority of the ovens in operation, there are at least 1,000,000 to 2,000,000 tons of coke annually consumed and lost in our bee-hive ovens which, by anything like reasonable care and attention, could be saved. As the average value of coke in 1901 was more than $2 per ton, this represents a very large money value.

This waste is worse than useless. The excess of heat available from the gases, as shown by tests of a great variety of coals in the retort-ovens and ordinary tests of single bee-hive ovens, demonstrates to my mind that there is not a good coking coal which could not be coked in bee-hive ovens by the heat derived from the combustion of its gases alone, and that the burning up of any coke which has already been formed is therefore a positive, unnecessary loss.

But more than that; the burning of a portion of the coke necessarily results in the deposition of ash on the remainder. This retards the transmission of heat from the hottest portion of the oven (just above the coke) to the unburnt portion of the coke toward the bottom of the oven; and, moreover, when the oven is watered down, this ash is washed through the pores of the coke and retained there, thus increasing the ash beyond its normal and proper proportion. A careful examination will disclose this ash in the pores of the coke. I have known cases, where the coal was naturally high in ash (and therefore the ash content was a matter of the greatest importance), in which enough coke was consumed to add 4 per cent. of ash to the entire product. In nearly all cases the increase of ash due to the burning of coke is conspicuous.

The theoretical yield of the coke can be determined within a fair degree of exactness from the proximate analysis of the coal. The coke carries all the ash and fixed carbon, and, even under the best work, a certain portion of volatile matter and moisture. The sulphur will probably be distributed in the coke, as indicated in the analysis. In other words, a coal of the following composition: Moisture, 1.25; volatile matter, 26.30; fixed carbon, 66.05; and ash, 6.40; total, 100—may be expected to give a theoretical yield of 66.05 + 6.40 = 72.45 per cent. of coke. To this should be added at least 1 per cent. for the moisture and volatile matter, which are retained by average "good coke," so that the theoretical yield of coke made from the above coal can be assumed to be 73.45 per cent. Dividing the fixed carbon, ash and 1 per cent. of moisture and volatile matter by that figure, we would get, for the coke made from this coal: Fixed carbon, 89.92; ash, 8.71; volatile matter and moisture, 1.36; total, 99.99

In carefully burned ovens, the ash should not be increased or the carbon reduced by more than 0.5 per cent. from the figures obtained by calculations like the above, and the volatile matter and moisture may both be reduced from the above figures, though they are often greater. There are various modifying factors, the exact measure of which cannot be accurately determined. Among these is the deposit of carbon from decomposition of the gases. The amount of ash is inversely proportional to the yield, so that increase in the yield at the same time decreases the ash. It is not uncommon to claim an advantage from an increase in a coke, up to a certain point, of ash of suitable composition, as a means of hardening the structure; but I suppose no one will claim any advantage from the ash which does not form part of the structure, but is simply derived from outside sources, either by collection or otherwise. This latter ash is simply paid for as coke, and then must be got rid of. It must not be confounded with that which enters into the structure.

After the coal goes to the ovens, there are several ways in which the ash in the coke produced may be increased above the theoretical amount. A portion may be derived from the dirt filling around the trunnel head; a portion from forking the coke from a dirty yard; a small amount from the impure water used in quenching; but by far the larger amount comes from the ashes of the coke burnt up in the oven. As the latter is almost in reverse proportion to the yield, it is obvious that the advantage of yield is not confined entirely to the saving of coke, but goes hand in hand with improved quality.

The "commercial" yield will be determined by local conditions, and the character of the particular coal. It is the theoretical yield, less the losses in burning and of fine coke in handling, and increased by the ashes and dirt gathered as noted above.

In good coking coals, high in volatile matter, the "breeze" or fine coke will run 2 or 3 per cent. and the commercial yield should not be more than from 3 to 5 per cent. below the theoretical. It is possible to do better, but anything not so good may be considered bad practice. With higher fixed carbon in the coal, and particularly when the coal is low in ash, and will burn or "cut" readily by small leaks admitting air, the difference between the theoretical and the commercial yield may be between 5 and 10 per cent.; but first-class work should approximate the former figure.

The question of yield is involved to a greater or less extent in all the operations connected with handling the coke ovens. The conditions which permit of the greatest regularity of drawing and charging, in which the leveling is done as it should be, the ovens are watered down to the best advantage, and are worked to their capacity, etc., are all factors affecting the yield. A plant in which the discipline and management are good will naturally have a better yield than where the management is lax; but after all this is said, there still remains the difference due peculiarly to a special effort, or want of effort, in the way of handling the draft and the oven with special reference to this point.

The principal thing which affects the question of yield is the care and skill with which the drafting, or admission and exclusion of air to the oven is controlled.

The object or purpose of the drafting is to secure a satisfactory degree of heat at the right time, and as nearly as possible to secure this heat from the gases which are driven off during the process of coking, and which would otherwise be entirely wasted. The more nearly it is possible to completely burn out the coke at a satisfactory temperature, and leave the ovens in first-class condition for the next charge, without burning any of the coke which has been formed, the more nearly do we obtain perfect results. The mistake is commonly made of assuming that at all stages of the process, whatever may be the condition of the oven, an increase of draft means an increase of temperature and a decrease of draft a decrease of temperature. The most casual examination will show that this is not the case. At the first stage of the burning, before the gases which will add to the heat by their combustion have commenced to come off, it is possible to cool the oven by excessive draft; and it is common and advisable practice to cover the ovens immediately after drawing, and recover them after charging, with a view to their "catching-up" more rapidly. By this means the heat stored in the walls finds its way to the inside of the oven. There is apt to be a time, within the first 12 hours after an oven has "caught-up," when the amount of gas formed is in excess of the ability of anything like an ordinary draft orifice to furnish the necessary air to retain the oven at a temperature for perfect combustion. During this time, also, the trunnel head of ordinary size has great difficulty in disposing of the products

of combustion. Later in the process, this condition is reversed, and the amount of air is apt to be in excess of what is necessary to burn the gases which are coming off; and, finally, if the draft is not changed, it becomes greatly in excess of the requirements of the ovens. From this stage to the end of the burning it is thoroughly possible for an oven to continue to cool, even with the admission of a large volume of air. In other words, the heat furnished by the small amount of gas which is coming off and from the consumption of a portion of the coke, is less than the lowering of temperature caused by the loss of heat from the trunnel head and from radiation; and this difference is increased by increasing the draft. The attempt to hurry an oven which has been allowed to cool, and which is continuing to cool, while exhibiting a number of "candles," by giving to it an excess of draft, is often indulged in; but it will be found very much better to endeavor to burn the oven so as to keep the heat up to a maximum towards the end of the blast, at the time when it is needed most to reach the coal at the bottom of the oven, rather than to try to replace the heat by an effort to burn a portion of the coke. This effort is always disappointing in results. As a general proposition, I should say that, in nine times out of ten, the drafting is too heavy, and the oven can be brought out in better shape by a more uniform drafting extending overa longer period. As a rule, from 20 to 25 square feet in the form of a circular draft at the top of the door (which may be as much as 40 inches high) will be ample for the largest oven which it may be desirous to burn out, while this should be reduced by at least one, or possibly two, changes as the oven is burnt out, so that the amount of air shall at no time be greatly in excess of what is necessary to completely and clearly burn off the escaping gas.

As a rule I should say that the tendency is to make trunnel heads too large. Of course, they have to be large enough to take with sufficient promptness the coal from the larries; but the standard form of larry will readily discharge into an opening 12 inch in diameter, and I have never yet seen an oven or a coal which would not give better results with an orifice of that size, than with a larger one. Yet larger sizes are common. I know of one manufacturer whose standard size is 16 inches, or nearly twice the area of a 12-inch trunnel head. The latter is abundantly able to carry off, under the best conditions of drafting, the products of combustion; and any excess above this very materially increases the loss of heat, and interferes with the efficiency of the oven.

The small sized opening may be slightly inadequate at the beginning of the blast; but as the gases come off in smaller quantity and more slowly, it is invaluable in retaining the heat so much needed at the latter stage. The smallest trunnel head I have tried for a 12 foot oven was 11 inches in diameter; and the results were fairly good. The ordinary difficulties connected with prompt charging limit the size to 12 inches and upward, and I believe that the smallest size that can be readily handled by the charging facilities will be found the best.

The use of lids is extremely desirable. Properly handled, they mean a great deal as regards the matter of yield. The retention of heat in the oven is, of course, of the utmost importance. The ovens should be covered as soon as drawn. They should be covered when charged until they are "caught up;" and as soon as the oven is practically burnt out, the draft should be cut off entirely, and the trunnel head partially or entirely closed. This will aid in retaining the ovens in the best possible condition, and will prevent the burning up of a large amount of coke. Particularly should the doors and jambs be kept tight, and the smallest crack stopped. The consumption of coke from this cause is enormously larger than would be supposed at first sight.

It is almost impossible to make any improvement in the matter of yield without keeping records in such shape as to show what are the good or bad results of any method of treatment. It is absolutely necessary, therefore, that arrangements be made to calculate, from either the railroad or the larry weights, to within at least 0.25 per cent. of the actual yield, within one or two days from the end of each month. With this, there is the strongest incentive to endeavor to improve; and without it, there is the strongest reason for making no change, since it cannot be known whether a change is advantageous or not. It is impossible to give a form for such a record, because it will vary with each plant; but I would call attention to the fact that that portion of the coke and coal on the yard or in bins, or in transit at the beginning and end of each month, if carefully estimated, cannot introduce a large error; and any such error which is made one month is balanced in the succeeding months; so that, if actual weights be taken of the coal that goes to the ovens and the coke that is shipped away in each month, the other amounts being estimated, the results will be very close.

I submit the accompanying form as a valuable one for keeping the monthly record and comparing the work month by month. It is a copy of a report from a plant in actual operation.

Form for Monthly Efficiency Record of Coke Ovens.

	Tons.		Yield in Coal Used, Per Cent.				No. of Ovens Drawn.			Coal Charged per Oven.			Monthly Efficiency Record. Per Cent.
	Coke Made.	Coal Used.	Theoretical	Practical.	Actual.	Efficiency.	Possible.	Actual.	Efficiency. Per Cent.	Tons Possible	Tons Actual.	Efficiency. Per Cent.	
January, 1902....	8,911.65	13,957.00	75.95	67	63.85	95.30	3,405	2,925	85.93	5.25	4.77	90.85	74.39
February	8,565.10	13,215.70	77.59	67	64.81	96.73	2,995	5,935	99.66	5.25	4.42	84.19	81.15*
March	9,107.05	14,251.80	77.38	67	63.90	95.37	3,575	2,888	80.78	5.25	4.93	93.90	72.33
April.	8,853.20	14,403.55	77.30	67	61.46	91.73	3,416	2,910	85.18	5.25	4.95	94.28	73.67†
May.....	9,341.65	14,821.6	74.7	67	63.02	94.06	3,455	3,032	87.75	5.25	4.88	92.95	76.72‡
June	6,977.85	10,803.8	77.1	67	64.58	96.38	3,057	2,689	87.96	5.25	4.18	79.61	67.49§
July	5,506.45	8,448.4	75.0	67	65.20	97.31	1,812	1,644	90.72	5.25	5.33	101.52	89.62‖

* More 48-hour coke was made than 72-hour coke.
† The loss was in burning the coke overtime.
‡ The loss was in small charges.
§ The charges for the ovens are too small.
‖ All departments in coke manufacturing increased in efficiency, hence the good result.

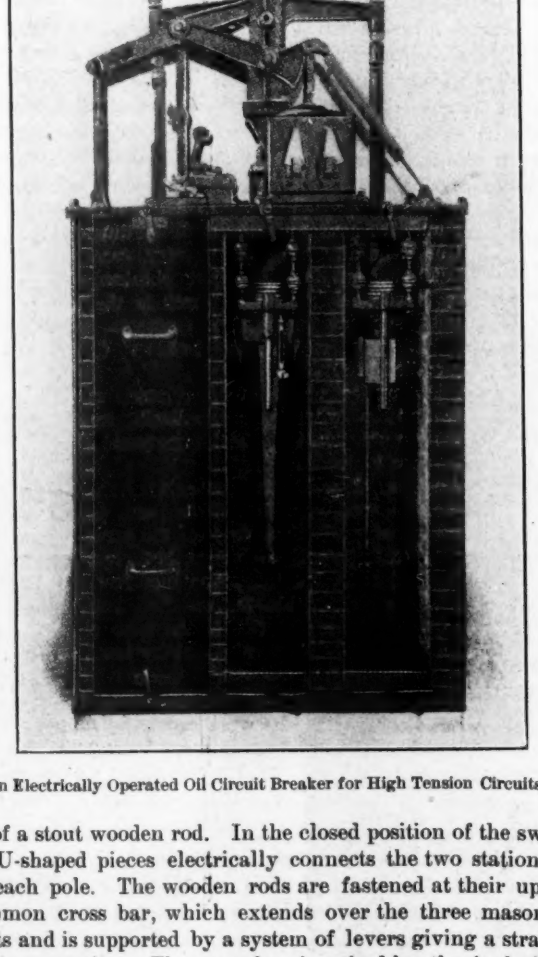
The monthly efficiency record will be found by multiplying the efficiency per cent. of yield; the efficiency per cent. of coal; and the efficiency per cent. of the number of ovens drawn, and will no doubt astonish some coke makers when they apply this form to their own operations. The theoretical yield is determined as explained above; and the practical yield is somewhat smaller, depending on the tendency to make fine materials or "breeze, the composition of the coal, the condion of the ovens, and equipment, etc.

An Electrically Operated Oil Circuit Breaker for High Tension Circuits.

Iron Age reports that the rapid increase during recent years in the size of central stations and the currents and voltages handled therein has necessitated a great development in the methods and apparatus for controlling and switching electric currents. While a few years ago most alternating current switchboards were equipped with hand operated knife switches, it is now found advisable and often necessary to use some means of auxiliary control. This permits the actual current switching devices to be located with regard to the general design of the station and a satisfactory lay out of circuits and apparatus; at the same time it centralizes the control within a small space where the operator may have under his hand, so to speak, the whole station, and before his eye an indication of the condition of every circuit.

One of the most remarkable pieces of apparatus which has contributed to make this great development possible is the high tension, power operated, oil break circuit breaker. While the carbon shunt open air type of breaker, in which the arc is ruptured in the open air, has given excellent service in most classes of work, there are many places where, on account of space or other limitations, its use would not be feasible. It is to meet the need of a compact, safe and reliable device for rupturing high tension circuits that the oil break circuit breaker has been developed. The accompanying illustration shows a three-pole, double break, automatic oil circuit breaker, operated by electro magnets. The circuit breaker is erected in a masonry structure with each pole and oil tank in a separate, fireproof compartment. There are two stationary contacts to the pole, one connected to the incoming lead and the other to the outgoing lead of the same phase, each contact being mounted in a large porcelain insulator. In the illustration one of the porcelain insulators is visible in the right hand compartment.

The insulators are fastened to a cast iron frame, which also supports the inclosing oil tank. The frame itself is supported from the soapstone slab at the top of the masonry walls by strain insulators. The movable contact for each pole consists of a U-shaped piece of copper fastened to



An Electrically Operated Oil Circuit Breaker for High Tension Circuits.

the end of a stout wooden rod. In the closed position of the switch one of these U-shaped pieces electrically connects the two stationary contacts of each pole. The wooden rods are fastened at their upper ends to a common cross bar, which extends over the three masonry compartments and is supported by a system of levers giving a straight line up and down motion. The cross bar is raised by the inclosing magnets, assisted at the beginning of the motion by a pair of balancing springs. The springs and the case containing the magnet are at the upper right hand corner in the illustration. A toggle joint, shown at the left in the illustration, automatically locks this system of levers when the circuit breaker is in the closed position.

The toggle joint is released by a blow from the tripping magnet, whereupon the cross bar under the influence of gravity and a powerful spring quickly drops, opening the contacts. The break takes place first at the main contacts and then afterward at a removable plug attached to the stationary contact which enters a hole on the movable contact. The plug thus receives all the effects of any arcing that there may be, and, since it is removable, is easily replaced. The current for the closing and tripping magnets is derived from the exciters, storage battery, or other source of low voltage direct current supply. If necessary the circuit breaker can easily be operated by hand without disturbing the mechanism in any way. The oil tanks, one of which is to be seen in the middle compartment, are constructed of heavy sheet metal and the interior is lined with insulating cement, which is molded to fit closely about the terminals and moving contact piece, leaving just room enough for the free movement of the parts in oil. By this means the amount of oil is reduced to a minimum. When the circuit breaker is open the wooden rod interposes an effective barrier between the two terminals of each pole. Suitable levers are provided for handling the tanks, which may be lowered away from the contacts and removed without disturbing the rest of the circuit breaker. The entire circuit breaker may be set in place and all parts adjusted before the oil tanks are placed in position. When necessary the tanks may be filled without removing them from their position. The oil level is easily seen by means of a small sight gauge. The tanks are insulated from the circuit, and, all the live metal parts being immersed in oil, there is no possibility of receiving a shock from touching the breaker.

Mounted on each circuit breaker is a small double pole, double throw knife switch, which is used with the indicating and tripping circuits and is operated by the motion of the levers of the circuit breaker. The controlling and indicating devices consist of a controlling switch, an electro-mechanical tell-tale indicator and a lamp. These are suitably mounted at the operating platform. A polyphase overload relay, connected to series transformers in the main circuits, is provided for automatic opening. The controlling switch, which is of the drum type, has three positions—namely, "closed," "off" and "open." It will remain of itself in the "off" or the "open" positions only. In other words, if it is thrown in the "open" position it will remain in that position when the hand is removed, but if it is thrown to the "closed" position it will turn of itself to the "off" position as soon as the handle is free. In the "off" position it connects the control circuit so that if the oil circuit breaker opens through the action of any of the automatic devices the lamp will be lighted on the operating stand to attract the operator's attention. If the oil circuit breaker is opened by the operator throwing the controlling switch to the "open" position the lamp does not light.

The mechanism of the electro-mechanical tell-tale indicator consists of an electro-magnet which attracts a pivoted armature through an angle of about 90°. Attached to the armature is a disk with a pointer which indicates to the eye the "open" or "closed" position of the oil circuit breaker.

In the accompanying illustration the closing magnet is partly hidden by the overload relay. This operates on the principle of the single phase induction motor. Each of the sectors swings between the poles of an alternating current electro-magnet. Part of each pole is surrounded by a short circuited strip of copper, which acts to retard the magnetic flux and thus produce a shifting field. This tends to move the counter-weighted sectors which carry a contact closing the tripping circuit of the circuit breaker. The two sectors are connected in parallel and either alone will trip the breaker. The currents for their magnets are derived from the phases of the main circuit by series transformers.

The apparatus described above, known as the "Type C circuit Breaker," is manufactured by the Westinghouse Electric and Mfg. Company.

Electrical Work in the Phillipines.

By Mr. Wm. Gilbert Irwin, in *Electricity*.

Some wonderful opportunities for electrical work are now offered in the Phillipines. Under Spanish rule a crude system of electrical lighting was in operation in Manila, and in several other of the large towns on the islands. Manila also had an antiquated telephone system, while the telegraph apparatus was of a pattern in use in this country probably twenty years ago. Up to the time of the American occupation about the only modern application of electricity on the islands was in the cable station. So far as electric railways are concerned Manila still depends upon the old horse car lines, although the question of electric railways has lately come in for considerable attention, a company having been formed for the transformation of the old horse car lines into electric ones.

American capital is back of this and many other projects in the islands. The old horse car line in Manila, the Transvias de Manila, has a good track, and the cars are as large as the standard electric cars in use in this country. The road is probably ten miles long, starting from near the Manilla & Dagapan Railroad depot in New Manila and traversing the streets of New Manila to the Bridge of Spain, with a line running down the Escolta, the principal street of the new city, and out through Qualpo and San Sebastian to the suburbs. The main line crosses the Bridge of Spain to the old Manila side of the Pasig, and one line enters the gates of the old walled city, while another runs out to the Lunetta, and through Ermita and other suburbs along the bay.

At present the cars are hauled by diminutive ponies, and the regular fare is two-centavos, equivalent to one cent in our currency. As soon as the rapid transit system proposed is inaugurated the rates will be revised. While there are thousands of carromatos and other light pony carts in use in Manila, these rude horse car lines are always crowded, and the conversion of the line into an electrical one is certain to prove a good investment.

The chief source of value of this crude transportation system lies in the fact that it controls the franchises for railways in the city, and it will prove very valuable as the nucleus for an extensive electrical system. Manila with a population of something like a third of a million people, can well support an electrical system of fifty or one hundred miles, such as will be in operation a few years hence. In addition to the numerous lines which will be built in the old and new cities, a number of lines will be constructed to connect with nearby populous towns. A line from Manila along the Bay to Cavite is proposed. Such a line would be probably fifteen miles long and would have a population in Cavite and along its line of probably 100,000 to draw from, in addition to the population of Manila. Another line up

the Pasig to Lay Bay is proposed, and a line will be built along the northern shore of the bay to Malabon, and other towns. At one time an old steam tramway was operated between Manila and Malabon, and the Manila & Dagapan Railroad now operated in that direction is enjoying a heavy traffic.

Soon after the American occupation of Manila the electric light plant was taken over by a new company, the company reorganized with an increased capital, and the old plant was thoroughly overhauled. For a time the stock of the new company was on the market but it was soon bought up, and the company is now paying handsome dividends, affording an apt illustration of what is to be accomplished in other ways in electrical work in the islands.

The telephone system in Manila has also undergone many improvements. For a long time this work was entirely in the hands of the American army, but lately a private company has takeu over the property, and now that modern equipments have been supplied, the service is in general use, more than 1,000 instruments having been installed.

Numerous improvements in the telegraph lines are also being made, and a number of new lines are building. The work of the American army in exrending its telegraph system over the greater part of the island of Luzon, has done much in the way of telegraph improvements.

Ilo Ilo on the island of Panay is now enjoying an electric lighting plant, and this modern convenience is being introduced into other of the towns. Our Government will be a larger user of electricity in the islands and this will insure a handsome profit for those who invest in such work. Already this agent is used about Manila for harbor lighting, operating coaling plants, etc., and it is largely in use at the naval station at Cavite. During the past year or two American electrical manufacturers have been shipping large consignments of electrical supplies to Manila and a permanent trade in these materials has already been established there. The modernization of the electric lighting plant in Manila has occasioned a large demand for arc lamps. incandescent bulbs, and other supplies, and as the electrical development of the islands proceeds the demand for all kinds of electrical products will increase.

The work in this direction already accomplished in Manila and in other parts of the islands, scarcely gives a correct idea of the great opportunities offered for such work in this vast archipelago. Many American electrical engineers are on the ground, and a number of large American firms are represented. Now that American capital and genius are represented in this new field it is certain that the next few years will see immense developments in all the various applications of this modern agent. One American firm has consigned thousands of electrical fans to Manila, the demand for this product owing to the great heat, being almost unlimited. The numerous waterfalls of the islands will eventually be turned to the purposes of modern industry, as has been the case in this country, and altogether electrical work is destined to be one of the most potent factors in modernizing the archipelago.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Jan. 10th, 1903.

The Weather and the Chronic Kicker.—Dangers of Electricity.—Subways for Important Thoroughfares.

The Christmas season has on this occasion proved a fairly easy one for the responsible managers of gas works, owing to the comparatively mild weather that has prevailed throughout. A steady run on gas fires all day, followed by 6 or 8 hours of extra brilliant lighting for the festive season at night, is a heavy tax on the resources, and one does not regret a little relief even if it tells on the output, for a high peak load is not the most profitable condition of working, and severe climatic conditions during the shortest days entail a heavy expenditure in all departments, indoor and outdoor. The working results, both in the retort house and purifying house, are not so good, and in the district there are complaints of frozen pipes, meters, etc., etc. These extra expenses go a long way towards discounting the advantage of an extra output. The net balance available for dividend is, after all, a more important item than the gross turnover. As usual, predictions were freely put forth, during October and November, that the coming winter would be one of exceptional severity, and yet it is quite appropriate, even in the second week in January, to allude to the coming winter, because it has not come yet. December opened in old-fashioned, frosty style, and after a few days of dry freezing or snow in places, the prophets were beginning to say "I told you so," when a thaw set in and the temperature has since been so high as to reduce the need for artificial warmth to a minimum. Yet the demand both for gas and for coke has continued fairly good.

One advantage of a mild winter is that it takes the wind out of the sails of the chronic grumbler, who is always strongly in evidence as soon as the March quarter's accounts go in, judging the amount of the charge for gas used during January and February in the light of his practice during April and May, oblivious of the hours during which the gas was left burning to keep the water pipes from freezing, or to take the rawness off the air in the passages and bedrooms, and accounting for the difference by obscure yet none the less unmistakable inferences as to the reliability of the meters or of the men who "take" them. On this point some unusually pertinent remarks were recently published in a Manchester newspaper, and gas companies who are annoyed by the misrepresentations of the chronic grumbler might do worse than follow the lead thus indicated. During the 6 months ended 31st March, 1902, over 2,000 complaints were received at the gas offices, or 1½ per cent. on the total number of meters in use. The meters were tested, and only 94, or less than 5 per cent., proved to be incorrect, and of this number the error was not invariably against the customer. Some attempt has been made to form a Gas Consumers' Protection Association in Manchester, but without success, and the writer of the article, who appears to be to some extent inspired, but nevertheless keeps to plain truths, goes on to inquire who is to be protected, and from whom, or what is protection to be afforded. But the pith of the whole matter is contained in the remark that, while such a society might do useful work in collecting and distributing information, it seems impossible to educate the average gas consumer on the importance of paying some little attention to the fittings in his own house and under his absolute control, with a view of getting the full value from the gas used. And the need for such information is rendered the more evident by the absurdity of published statements as to the composition, manufacture and distribution of gas. One writer has asserted that all that was done to remedy a complaint of bad gas was to pour "some sort of spirit" into the pipe and set fire to it. So far the open mild weather and freedom from fog have not called for the usual run on gas, and some speculation is put forth as to whether those who grumble at large bills will have anything to say when the account is below the average. To this it may be replied that they will have something to say—but not until after the quarter end following tbe next cold snap.

Although the grumbler, like the poor, is always with us, it rarely happens that he can command a majority, as the bulk of the community are amenable to reason, and the best antidote to the limited amount of mischief he is able to accomplish is the publication of plain facts, in a brief and sensible form, that will insure a reading. A man that has been at work all day at a regular occupation is not likely to sit down in the evening and apply himself to the assimilation of a pile of statistics, however valuable or instructive, and one cause of the very limited degree of success that has so far attended the endeavors of those who seek to educate the gas consumer is that the lesson is made too long and too stiff. It is a disputed point whether people ever read notices on the bills. I know a company that has for years put a notice in prominent red type on every bill requesting prompt intimation of defects; and by chance it transpired that a large consumer and shareholder had never observed and was not aware of such notice. But if they will not read a few lines on a bill or circular, they certainly will not swallow a 32-page pamphlet. The best way of putting out the information is largely a local affair, according to the class of customer to be dealt with. The object of these remarks is to accentuate the importance of telling the customer something beyond the bare fact that he has burnt 20,000 cubic feet of gas, and had better, to avoid unpleasantness, pay up on or before the 30th inst.

An incidental danger attendant upon the use of electricity is illustrated by a fatality at some public baths in London, whereby two young men lost their lives. They went in together and applied for warm private baths in the usual way. The bath rooms or compartments are arranged in rows, separated by vertical partitions about 7 feet high, lighted by electricity, the wires in connection with which are carried through steel tubes placed along the top of the partitions. Hearing a scream from one of the compartments, the attendants broke in and found one of the young men clinging to the pipe containing the electric wires. The current was shut off and the man removed, but attempts at artificial respiration were ineffectual, and he died in a few minutes. His companion, who was in a compartment a few doors off, was found dead on the floor. The supposition is that the men endeavored to communicate with each other, and for that purpose attempted to raise themselves so as to look over the partition by placing their hands on the top edge, thus covering the tube

containing the electric wires, at the same time standing on the edge of the bath, which would be an excellent conductor. They thus short circuited the electricity from the wires to earth through their own bodies. The strength of the current was stated to be 165 volts. Several other bathers complained of having felt shocks, from which it appears possible that one of the men at any rate might have met with his death by touching some metal work on the partition while in the bath. The medical evidence at the inquest was to the effect that both the men were healthy, and that death in each case was due to electric shock. An expert stated that the cause of the leakage of electricity from the tubes was a defect in the connection between the wires and the lamp holders to which they were attached.

If the architect's specification had been properly carried out, it would have been impossible for anyone to get even an inconvenient shock, if the steel tubes had been connected to earth, the leakage would have been indicated by the melting of the safety fuses. The architect considered the system perfectly safe, provided his specification was carried out, and that the fatality occurred through some defect in the wires. A government inspector, Mr. Ram, said that the system was perfectly safe, with the exception that the pipes were not earthed. If continuous tubes had been used, and these conducted to earth, there would have been no danger. The jury returned a verdict to the effect that the death was caused by an electric shock, due to the faulty design and construction of the electric lighting installation, but were unable to say who was to blame. Considering that currents of 200 volts are largely used, and that the above occurrence proves them to be capable of causing fatal results, it is evident that some arrangement of safety fuses or other means of indicating the existence of a leak or defect is an urgent necessity. Even if wires are so placed as to be out of reach under ordinary circumstances, one cannot be sure that a workman called in for a particular job, may not happen to put his hands upon them. Usually some insulating covering is used and it was not stated whether this was so in the building in question. According to the verdict of the jury, we do not yet know everything about electricity.

Visitors to London will not be surprised to hear that some attention is being directed to the frequent disturbance of the principal streets by the supply companies having mains or conduits laid under the soil, and the interference with traffic and with the business in the neighborhood of the obstruction, and the consequent inconvenience not to say danger to the public, together with annoyance, loss and damage so far as the local parties are concerned. Things were bad enough when the public utilities were confined to gas and water, but with the addition thereto of post office and telephone lines, electricity conductors, and high pressure hydraulic mains, to say nothing of the increased attention to sewers and drains necessitated by an enlarged population, the question becomes extremely acute in the principal thoroughfares. Gas companies are not the worst offenders. Once laid, their mains do not require inspection or attention of any kind for many years. A new or enlarged service may be necessary from time so time, but this can usually be managed at night, and the drip boxes, if there are any, can also be attended to at times when the traffic is at a minimum. But some of the other companies require to put down manholes or surface boxes and to use them frequently. We may also turn the tables on the local residents, who have coal shoots and other communication with cellars and vaults which are frequently extended under the pavement as far as the curb, and have vans standing for some time before their doors, for bringing in or taking out goods and merchandise. It is a common reflection upon public companies that they exist only for the purpose of profit, and, therefore, should not be considered.

But in this respect they stand on exactly the same footing as a shopkeeper or any person that opens a place of business, besides contributing in a much larger proportion towards the public rates than a private individual. However this may be, the annoyance to a person having a frontage on a street carrying some seven or eight public utility supplies is very real, especially when obstruction means a diversion of traffic, and of a considerable share of custom into other streets. The only remedy that is available, so far as underground pipes are concerned, is a tunnel or subway. Although these were proposed many years ago, and it was pointed out that the advantage of ready access to mains would be sufficient to command a handsome rental from public companies, enough, in the opinion of some enthusiastic projectors, to afford a good dividend on the outlay, the expense has hitherto proved prohibitive, and the underground subway has as yet been on a strictly limited scale. One of the latest suggestions in this direction has relation to the portion of the Strand near Charing Cross, one of the busiest thoroughfares in London, and comprises an underground way or passage extended over the whole width of the roadway. The central portion carries a double row of tram lines, adopted for electric trams; one side is to be utilized for passenger traffic and the other for mains and pipe lines. The sewers are on a level below the center. So far as the distribution of gas is concerned the subway would be a good thing. The mains could be painted and protected against corrosion, and the service junctions could be similarly secured. Some special precautions would be called for in the case of pipes of six or seven different denominations laid close together, that are not required when each has a separate bed to itself. But the advantage thus secured to the public utility companies would be dearly bought at a rental sufficient to give an adequate return on the outlay. It would simply mean an increase in the price of such utilities, and it would be scarcely fair to put the cost as a charge upon the consumers of such. The subway is entirely a local affair and should be chargeable to the rates.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. WILLIAM BATHGATE, formerly Manager of the Winnipeg Gas Company, died at his home in Winnipeg the morning of the 23rd inst. He was in his 71st year.

A CORRESPONDENT forwards the following from Fort Dodge, Ia., under date of Jan. 24th: "After a period of nearly 20 years, during which time the public of Fort Dodge has been compelled to accept an inadequate lighting system because of the refusal of the controlling stockholders of the light plant to expand their system, the city is at last to have a lighting system, both electric and gas, which may not be pointed out as an obstacle in the path of its growth. The Fort Dodge Light and Power Company is to expend a large sum for improvements which are to be begun at once. Both the electric light and gas plants are to be rebuilt and enlarged, while the street car system will be more than doubled in trackage and equipment. The expansion policy of the Light and Power Company is due to the change in the controlling interest which took place in July of last year."

THE Chicago shops and storeroom of Messrs. D. McDonald & Co., of Albany, N. Y., have been removed to the premises, corner Jefferson and Monroe streets.

AT the annual meeting of the Gloucester (Mass.) Gas Light Company Mr. Robert R. Fears was elected President vice the late Mr. George R. Bradford. Mr. Charles R. Fisher was elected to fill the vacancy on the Board of Directors. The Directors adopted the following minute to the memory of Mr. Bradford: "The Directors of the Gloucester Gas Light Company desire to place upon their records testimony by the Company to the services of its late President, George R. Bradford, who served it as a Director since June, 1872, and as President since January, 1893. His advice and assistance to the officers of this Company have been of great value, from his long business experience and the interest he took in its good service. His death causes the loss of a valuable adviser, a pleasant companion, and a good friend. By a rising vote the above to be placed on our records and a copy sent to his family with our sympathy."

ALDERMAN SHEPPERD, of the Windsor, Canada, City Council, has asked for the appointment of a committee to investigate the advisability of the purchase of the properties of the Windsor Gas Company, with a view to operating the same on public account.

ASSEMBLYMAN HINSON has introduced a bill in the New York Legislature which proposes to establish the office of State Gas and Electrical Chemist. The salary of the proposed officer is put at $2,500, and it is provided that the appointee must hold a college certificate as professor of chemistry, and his duty is to test the illuminating power of gas and electric light whenever requested to do so by any inspector of gas meters or other properly accredited municipal officer. Gas companies must report annually upon the substances other than coal used in the manufacturing of gas.

THE proprietors of the Perth Amboy (N. J.) Gas Light Company have applied for the right to carry their pipes to and through the streets of the adjoining district of Woodbridge.

MR. WILLIAM M. EATON has resigned the position of Manager of the Jackson (Mich.) Gas Company in order to accept the berth of Manager to the Grand Rapids (Mich.) Gas Light Company. Mr. S. E. Wolff succeeds Mr. Eaton as Manager at Jackson.

THE Fort Madison (Ia.) Gas Light Company seems to be doing quite well. At least that statement would seem to be borne out by the fact

that its earnings from private consumers last December show a gain of 53 per cent. when compared with those of December, 1900. The Company went into new control early in 1901.

A CORRESPONDENT forwards the following from San Francisco, under date of the 23d ult.: "The California Gas and Electric Corporation has announced that it will take up the stock of the Oakland Gas Light and Heat Company, held in escrow under an option by the First National Bank of San Francisco, closing on March 16. The stock will be paid for at the rate of $70 a share, the figure agreed upon in the option of purchase. With the absorption of the local Corporation there will be no change in its management. John A. Britton, the President and executive head of the Oakland Company, will remain in that position, and in addition becomes the General Manager of the California Gas and Electric Corporation. In connection with the impending transfer of stock Mr. Britton made the official statement that when the change is made there will be a material reduction to consumers of Oakland in the price of gas for lighting and fuel and also in the schedule of rates for electric power furnished for manufacturing purposes. This will be accomplished through the consolidation, which, it is announced, will result in a considerable lessening of the cost of manufacturing gas and generating electricity. The Bay Counties Power Company, which furnishes electricity to Oakland and other cities, is a subsidiary corporation of the consolidation. The larger organization is controlled by a syndicate, which was formed and developed by John Martin, who has been heavily interested in California gas and electric works for years. President Britton declares that he is confident, in fact knows, that the policy pursued in the past by the Oakland Gas Light Company toward the consumers of Oakland will be maintained under the new control."

THE sale of the plants and properties of the Norwalk (O.) Gas and Electric Company to the syndicate which controls the Cleveland, Elyria and Western Railroad, seems an assured fact.

At the annual meeting of the Mutual Gas Light Company, of Savannah, Ga., the officers elected were: President, S. T. Bodine; Secretary, J. W. Golden; Treasurer, Lewis Lillie; Superintendent, S. E. Linton.

AT the annual meeting of the shareholders in the Houston (Tex.) Gas Light Company, the Directors chosen were: T. W. House, T. H. Scanlan, H. S. Fox, Jas. A. Baker, Jr., and Chas. Dillingham—the last named succeeds Mr. Jno. H. B. House, who refused a re-election. The Directors named the following executive managers: President, T. W. House; Vice-President, T. H. Scanlan; Secretary, Treasurer and General Manager, Jno. Shearn; Superintendent, J. H. Fitzgerald. The following resolutions were adopted:

Resolved, For the purpose of stimulating or increasing the use of gas and encouraging the prompt payment of bills for gas that, until the further order of this board, the price of gas be and the same is hereby reduced to $1.50 per 1,000 cubic feet to all consumers who pay their bills on or before the 10th day of the month following that in which the gas is used. To those who fail to pay on or before the tenth of the month the price shall be $1.80 per 1,000 cubic feet as heretofore. Be it further

Resolved, That all the bills for gas shall be payable at the office of the Company and no officer of the Company shall have authority to reduce the price below $1.80 unless payment is made on or before the 10th of the month following the month the gas is used.

DURING the year 1902 the output of artificial gas by the Indianapolis (Ind.) Company amounted to 275,421,700 cubic feet. When the output per annum reaches 300,000000 cubic feet, the Company will, under its agreement with the authorities, reduce its selling rate to 95 cents. The ruling rate is $1.

WRITING of the Indianapolis Company recalls to mind the fact that its well-esteemed engineer, Mr. James Somerville, some time ago met with a slip that resulted in a fractured arm. We are more than glad to say that the break is coming together in satisfactory shape, and that the accident will not deprive him of a single handshake at the coming meeting of the Western Gas Association.

THE following extract from a recent communication to the Mayor of Toronto, Can., by the President of the Consumers' Gas Company of that city, explains itself: "* * * The Company has found, in preparing its estimates for the coming year, that, owing to the recent installation of improved coal and coke handling plants, and to the adoption of the latest and most scientific methods in the production of gas, as well as to the large increase in gas consumption, and owing to economies which it has been able to effect in the general management of its business, it is now in a position to maufacture and distribute gas at a lower cost than heretofore. The Gas Company is not compellable, under its contract, to make any reduction in the price of gas for nearly 2 years to come, and then, if at all, only to a net price of 85 cents per 1,000. The policy of the Company, however, as evidenced by its numerous reductions in the past—no less than 12 in number—has always been to reduce the price of gas whenever possible, and in so doing to anticipate the requirements of its charter, rather than to fall behind them. This policy it proposes again to pursue in the present instance. It, has, accordingly, to-day, advised its consumers by public advertisement of a reduction in the net price of gas to 80 cents per 1,000 feet, to take effect from January 1 last, being the lowest price at which gas is sold in the Dominion, and, with three or four exceptions—mainly in the coal districts—the lowest in the whole of North America."

THE proprietors of the Lancaster (Pa.) Gas Company have announced that, owing to the increased cost of materials used in the manufacture of gas, the selling rate, until further notice, will be increased through a reduction of 50 per cent. in the concession heretofore allowed on account of prompt payment.

AT the annual meeting of the Laclede (Mo.) Gas Light Company the following officers were elected: Directors, E. McMillin, F. E. Ely, Jas. Campbell, I. H. Lionberger, F. J. Wade, J. C. Van Blarcom, John Scullin, T. J. Doerr and H. Scullin; President, Emerson McMillin; Vice-President, Jas. Campbell; Secretary, Alexander Ross; Treasurer, Chas. J. Owen.

THE following ordinance is being pressed to passage in the Board of Supervisors, San Francisco:

Section 1. It shall be unlawful for any proprietor, owner, lessee or person to turn off the gas supply at the meter or any other point on the supply pipe except at the stopcock on the gas fixtures, in any hotel, lodging house, apartment house or in any house or building wherein rooms are rented for sleeping purposes, except said gas supply is turned off for repairs or by reason of accident or in cases where the building is vacated.

Sec. 2. It shall be unlawful for any proprietor, owner, lessee or person to maintain or use in any hotel, lodging house, apartment house or in any house or building wherein rooms are rented for sleeping purposes, any gas fixture having a defective key or stopcock, or any key or stopcock which has not a pin or other device to prevent a reopening of the gasway by further continuous movement of the key or stopcock in the same direction after the gasway has been closed.

Sec. 3. Every person who shall violate any of the provisions of this ordinance shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not more than $500 nor less than $50, or by imprisonment in the county jail for a period of not more than 6 months nor less than 50 days, or by both such fine and imprisonment.

Sec. 4. Order No. 57 (second series), entitled "requiring certain regulations to be observed in the use of gas in hotels, boarding and lodging houses," approved February 25, 1898, is hereby repealed.

Sec. 5. This ordinance shall take effect and be in force from and after its passage.

THE Omaha (Neb.) Gas Company has paid into the city treasury, on account of its agreement with the authorities, the sum of $14,263.17, which amount represents a royalty of 5 per cent. on the Company's gross receipts for 1902. In 1901 the sum paid on like account amounted to $11,201.84.

THE following Trustees have been chosen to manage the affairs of the Williamsport (Pa.) Gas Company for the current year: Jas. B. Bailey, H. E. Gawtry, F. S. Male, Seth T. McCormick, Jno. S. Reading, T. W. Stevens, Frank Tilford, L. B. Gawtry and H. R. Wilson.

THE legislature of Illinois is to consider a bill having for its object the establishment of a State Board for the inspection of gas and meters. The office of the inspector is to be located in Springfield and his salary is to be $2,500 per annum. He is to have two assistants, salaried at $1,500 and $1,200 respectively, and the entire expense of the office is to be borne by the gas companies, the assessment to be made on the basis of so many mills per 1,000 cubic feet of yearly output.

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PROPRIETORS.

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Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, FEBRUARY 2, 1903.

The Market for Gas Securities.

The market for city gas shares showed nothing of importance in the way of developments during the week, although the average quotation was about a point in advance of the corresponding figure for a week ago. The closing to-day (Friday) was made at 216½ to 217. The annual meeting last Monday was well attended and the proceedings were both harmonious and interesting. The only change in the Board of Trustees was the naming of Mr. J. W. Sterling to succeed the late Mr. John P. Huggins. Something over 50,000 shares were voted upon.

The President's report was unusually interesting. Its figures showed that the Company sold 18,400,000,000 cubic feet, that the highest daily output was 80,000,000 cubic feet, and that the gain in sendout for the year figured out at 11.65 per cent. Its consumers number 556,053, and 32,000 consumers were put on during the year. The Company admits a gain in surplus for the twelvemonth of $600,000. Taken all-in-all this makes a pretty fair showing.

Brooklyn Union is unchanged. Washington (D. C.) gas has crossed the 400 mark, being 410 bid, offered at 415. Peoples, of Chicago, is exceedingly strong, and some of the shorts will know speedily that Peoples is a pretty good thing.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks,

16 WALL STREET, NEW YORK CITY.

FEBRUARY 2.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	216½	217½
Central Union, Bonds, 5's.	3,000,000	1,000	110	112
Equitable Bonds, 6's	1,000,000	1,000	105	
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	310	325
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	112½	113
Northern Union, Bonds, 5's.	1,250,000	1,000	108	110
New York and East River ..				
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	130	140
Preferred	5,000,000	100	150	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	115½	118
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	220	228
" " Bonds (5's)	15,000,000	1,000	119	119½
Bay State	50,000,000	50	¾	1
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	7½	10
" " Bonds, 5's	5,250,000	1,000	75	77
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Central San Francisco	900,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	99	99½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89⅛
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	103	106
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	70	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	.	.	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	85	87
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	852,000	1,000	77	79
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	.	.
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	.	68½
" Bonds, 6's	2,650,000	..	102	105
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	13,000,000	100	85	90
Preferred	2,500,000	100	100	110
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	112	120
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	25	87
Montreal, Canada	2,000,000	100	218	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	106⅜	106½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	.
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	41½	42½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	95	96½
Syracuse, N. Y.	1,975,000	100	29	..
Bonds	2,047,000	1,000	99½	100
Washington, D. C	2,600,000	20	410	415
First mortgage 6's	500,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	..

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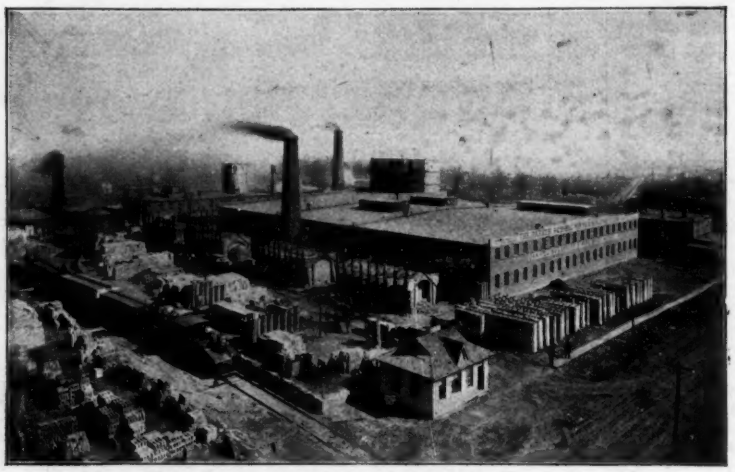

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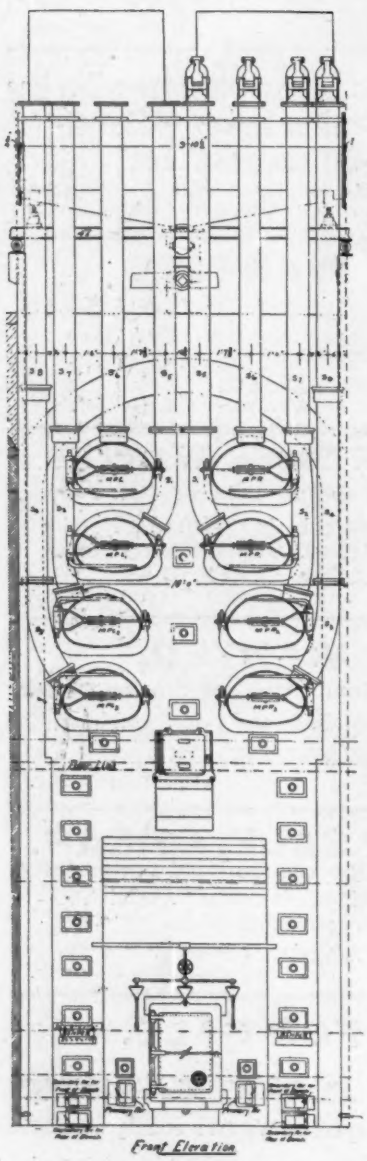

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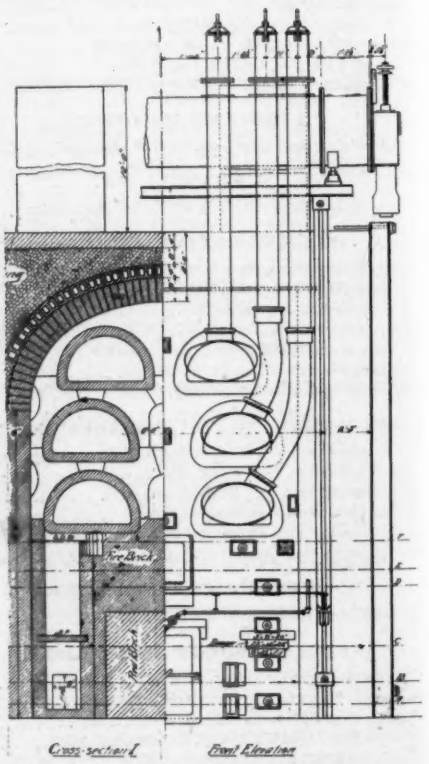

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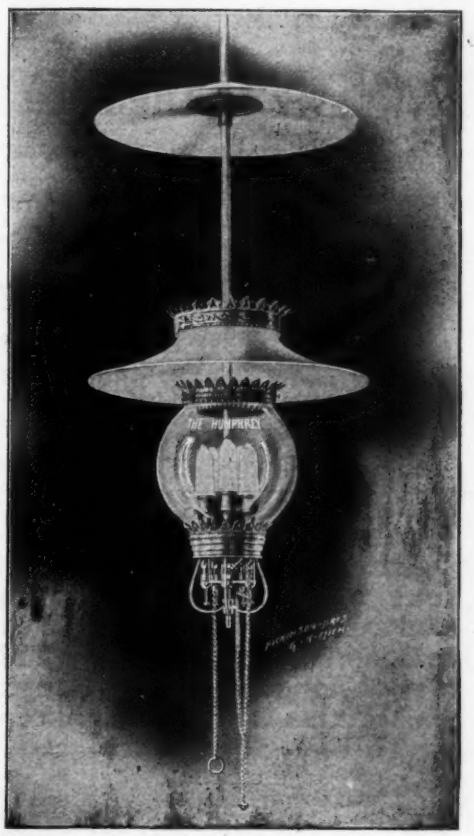

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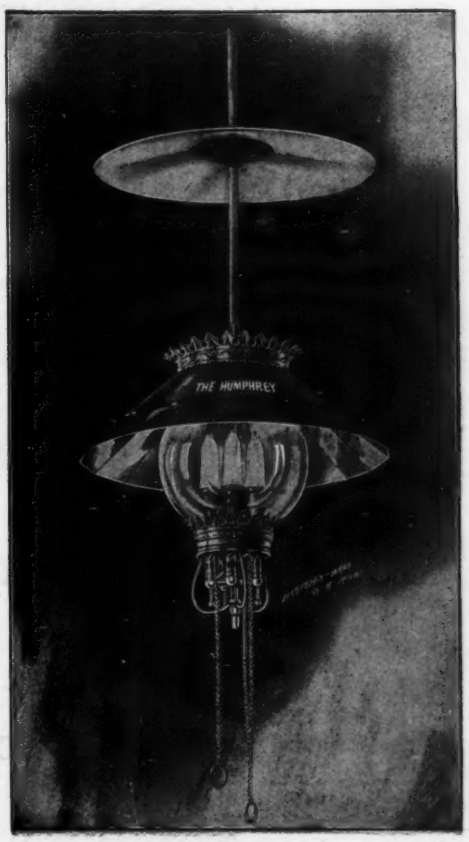

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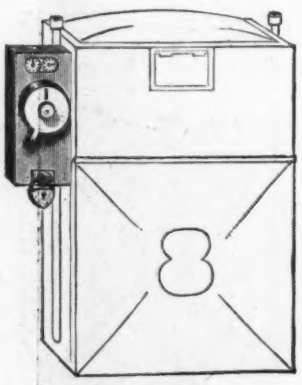

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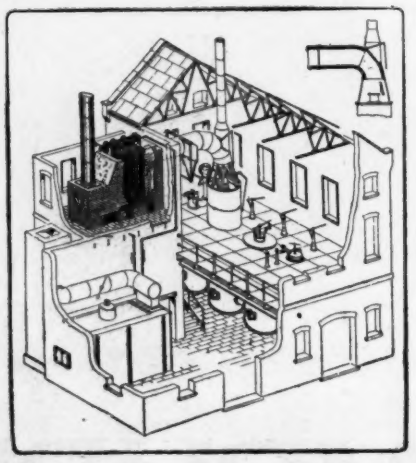

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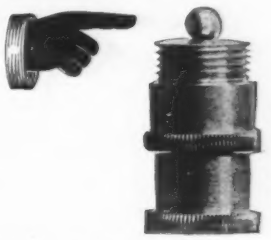

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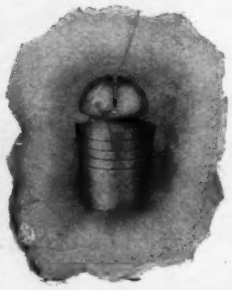

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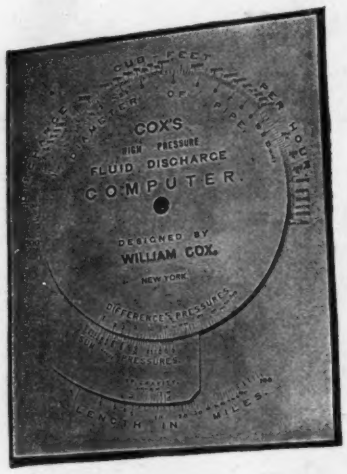

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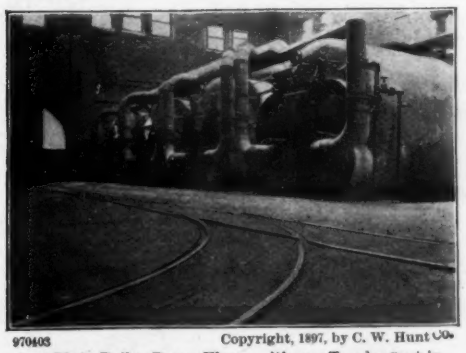

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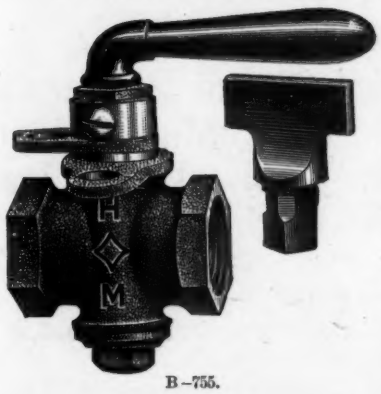

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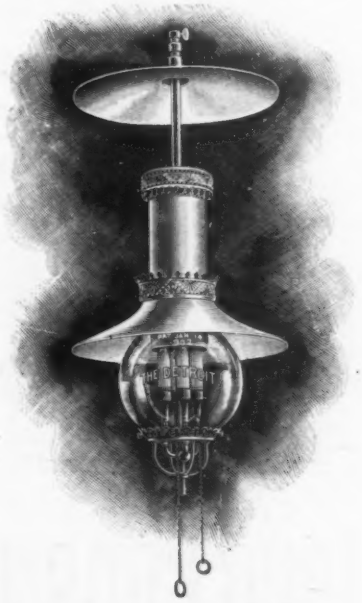

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TO LIGHT CONSUMPTION WHAT THE GAS RANGE IS TO FUEL. : : : : :

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Manufactured by

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Coal and Water Gas Plants.

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RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC.

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Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.

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With the Lloyd System of Valve Connections for Ordinary or Reverse Flow of the Gas.

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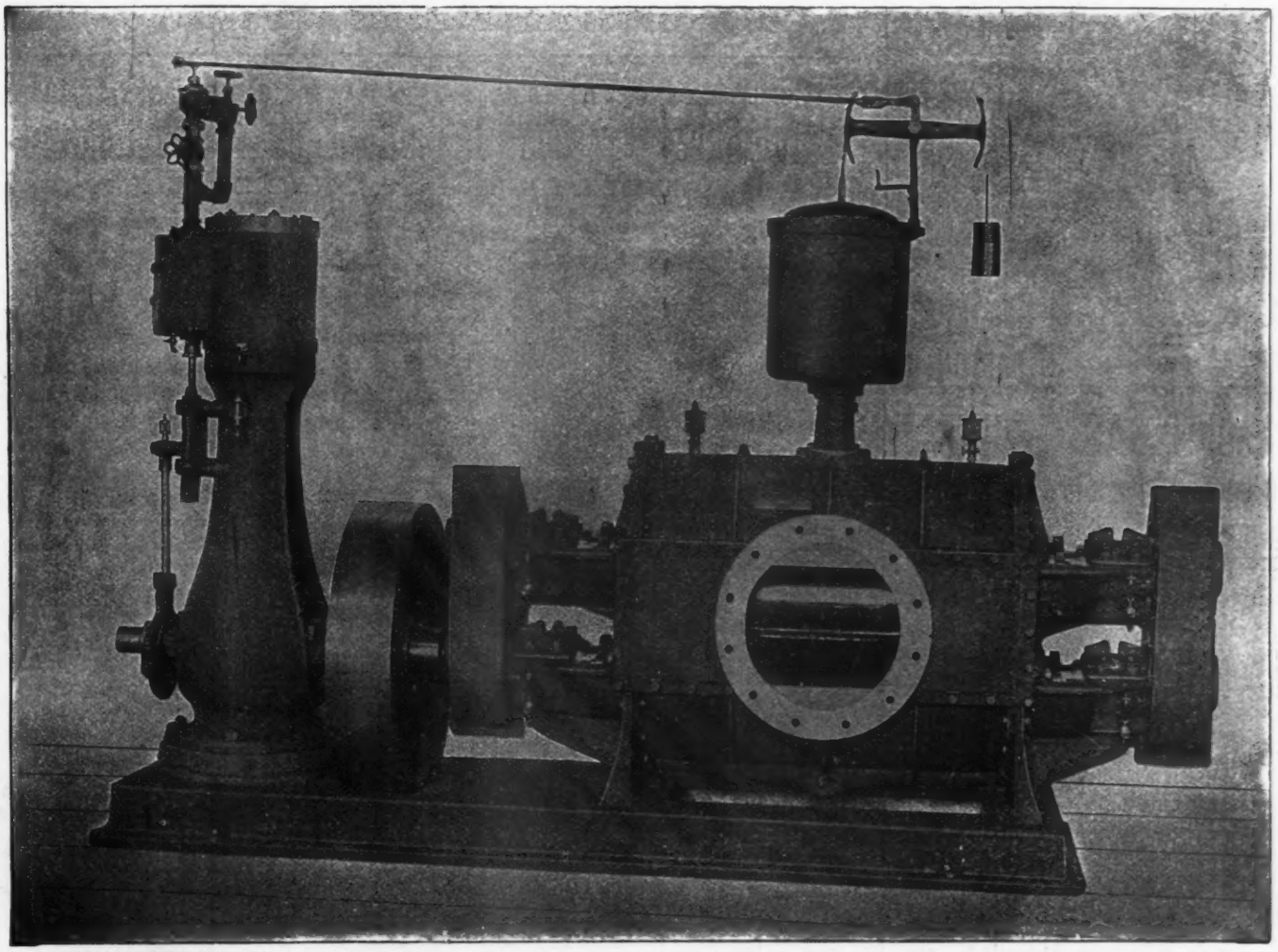
Always in the lead. Always anticipating the requirements of the trade. Our new Exhauster meets all demands of modern gas making and overcomes all difficulties heretofore experienced.

OUR GAS GOVERNOR IS MAKING FRIENDS EVERY DAY.



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GAS TAPPING MACHINES

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Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

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Hughes' "GAS WORKS,"

Their Construction and Arrangement,

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Originally written by SAM'L HUGHES, C.E.
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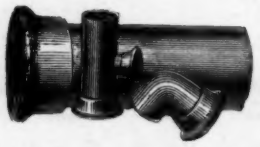

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For Shutting Off Gas in Mains

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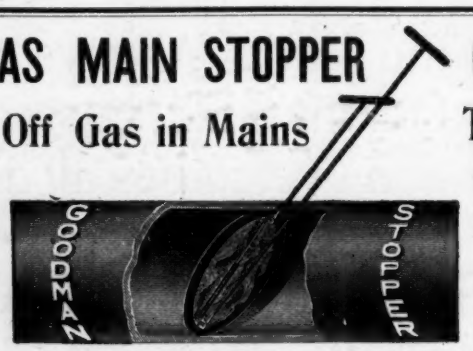

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Humphrey Crescent Instantaneous Water Heaters,

A LUXURY and NECESSITY.

This is Our No. 2 Heater.

Supplies hot water for domestic use as well as for the bath.

It Has No Equal

LIST PRICE NICKEL PLATED, $35.00,

including nickel plated shelf and brackets.

We have many styles, which range in price from our No. 10, at $45.00, to our No. 8, at only $20.00.

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Will send heater on 60 days' trial to any Gas Company.

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Parson's Steam Blower

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR USING COAL TAR AS FUEL.

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These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

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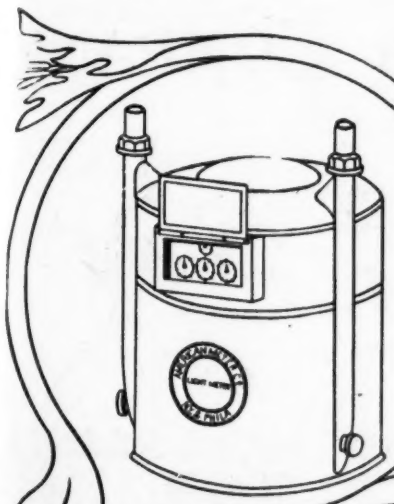
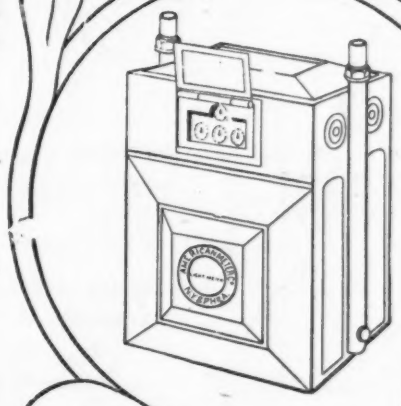
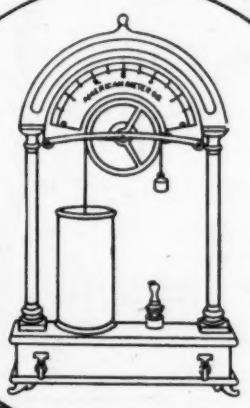
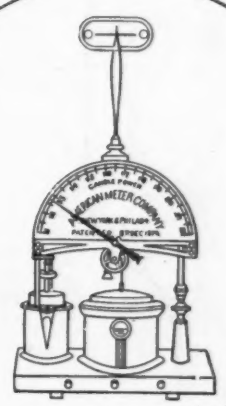
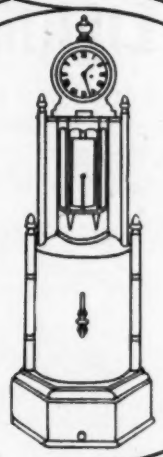
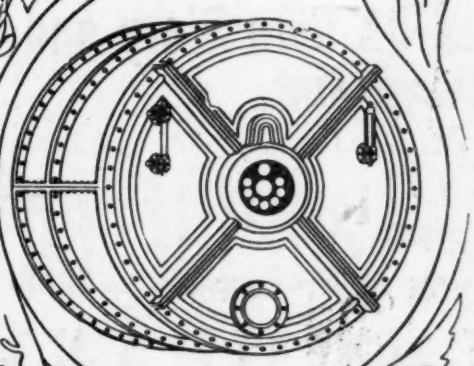


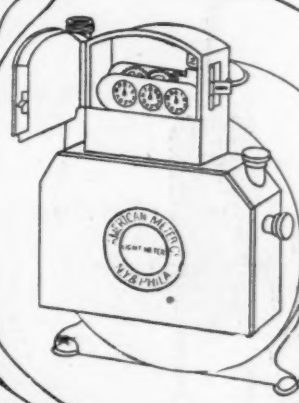












PUBLIC LIGHTING TABLE.

FEBRUARY, 1903.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Sun.	1	5.50 PM	6.10 AM	5.05	6.15
Mon.	2	9.30	6.10	5.05	6.15
Tue.	3	10.30	6.10	5.05	6.15
Wed.	4	11.30 FQ	6.10	5.05	6.15
Thu.	5	12.40 AM	6.10	5.10	6.10
Fri.	6	1.40	6.10	5.10	6.10
Sat.	7	2.40	6.10	5.10	6.10
Sun.	8	3.40	6.00	5.10	6.10
Mon.	9	4 30	6.00	5.10	6.10
Tue.	10	No L.	No L.	5.10	6.10
Wed.	11	No L. FM	No L.	5.10	6.10
Thu.	12	No L.	No L.	5.20	5.55
Fri.	13	6.00 PM	8.50 PM	5.20	5.55
Sat.	14	6.00	9.50	5.20	5.55
Sun.	15	6.10	11.00	5.20	5.55
Mon.	16	6.10	12.00	5.20	5.55
Tue.	17	6.10	1.00 AM	5.20	5.55
Wed.	18	6.10 LQ	2.00	5.20	5.55
Thu.	19	6.10	2.50	5.30	5.55
Fri.	20	6.10	3.40	5.30	5.55
Sat.	21	6.10	4.30	5.30	5.55
Sun.	22	6.20	5.10	5.30	5.55
Mon.	23	6.20	5.40	5.30	5.55
Tue.	24	6.20	5.40	5.30	5.55
Wed.	25	6.20	5.40	5.30	5.55
Thu.	26	6.20 NM	5.40	5.30	5.45
Fri.	27	6.20	5.40	5.30	5.45
Sat.	28	6.20	5.40	5.30	5.45

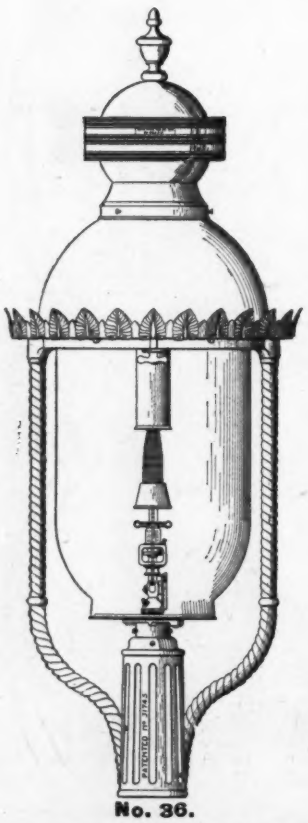
TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.

No. 38.

The Welsbach Gas Arc for Indoor Lighting.

The cut tells the story—but not all of it. Get one lamp and light it—then the tale's told from beginning to end. For one Welsbach Gas Arc Lamp is a better salesman than 20 pages of advertising.

Here's what it would show if you give it a chance to prove its worth:

1. A mechanical construction and finish that insures the greatest durability.
2. The renewal of mantles and the cleaning of globes without removal of globe.
3. The greatest amount of candle power with least consumption of gas.
4. A by-pass cock so constructed as to permit all or only one mantle burning at a time.
5. A pilot light that consumes but 1 foot of gas in 24 hours. Costs $\frac{1}{10}$ of a cent a day.

Give it a Chance to Tell its Own Story and it Won't Disappoint.

Let us send you one lamp—doesn't cost a fortune—and it will answer every question you put to it; make good on every test given it. You know the only proof of the pudding? What's the use in a fellow telling you it tastes good? Taste it yourself, then you know.

May we Send you ONE Lamp?

WELSBACH COMPANY,

GLOUCESTER, N. J., and CHICAGO, ILL.

THE UNITED GAS IMPROVEMENT COMPANY

During the Year 1902 has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

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Auburn, N. Y.	Houston, Tex.	Ocean City, N. J.
Belmar, N. J.	Indianapolis, Ind.	Oklahoma City, O. T.
Blue Island, Ills.	Jersey City, N. J.	Oneonta, N. Y.
Boonton, N. J.	Laconia, N. H.	Plainfield, N. J.
Brooklyn, N. Y.	Lakewood, N. J.	Portland, Me.
Carlisle, Pa.	La-Salle-Peru, Ills.	Pottsville, Pa.
Champaign, Ills.	Martinsville, Ind.	Scranton, Pa.
Coney Island, N. Y.	Memphis, Tenn.	South Brooklyn, N. Y.
Dallas, Tex.	Newark, N. J.	Suffern, N. Y.
Danville, Ills.	New Brunswick, N. J.	Swedesboro, N. J.
Des Moines, Ia.	New London, Conn.	Syracuse, N. Y.
Evanston, Ills.	New Orleans, La.	Washington, N. C.
Evansville, Ind.	Norfolk, Va.	Woonsocket, R. I.

TOTAL SETS, 1902, ... 51
TOTAL DAILY CAPACITY, 1902, . . 32,825,000 cubic feet.
TOTAL SETS TO DATE, ... 447
TOTAL DAILY CAPACITY, ... 299,670,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. T. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

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FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

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CLAY RETORTS, FIRE BRICK,
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Office, 88 Van Dyke St., Brooklyn, N. Y.

Established 1854. Incorporated 1869.

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Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

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Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

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Adam Weber Sons.

Works, Weber, N. J.
Main Offices, Park Row Bldg., New York.

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

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Construction Vertical 8's (Patented)
First Instalment in the World
with Modern Charging and
Discharging Machinery.

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Perforated Radial Block Chimneys.

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Fire Clay Goods for Gas Works.

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EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS
WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT
A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

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By HENRY O'CONNOR.

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Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

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PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

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Silver Medal, Paris Exposition.

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Jeffrey Detachable Chain.

FOR HANDLING

COAL, COKE, ETC.

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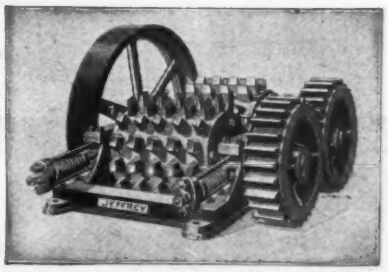

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STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
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HIGH GRADE

GAS OIL

A SPECIALTY

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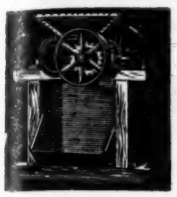

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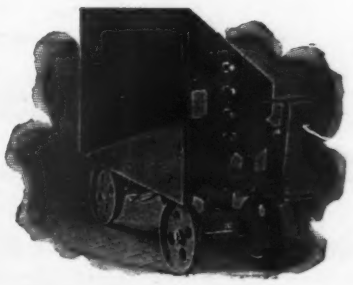

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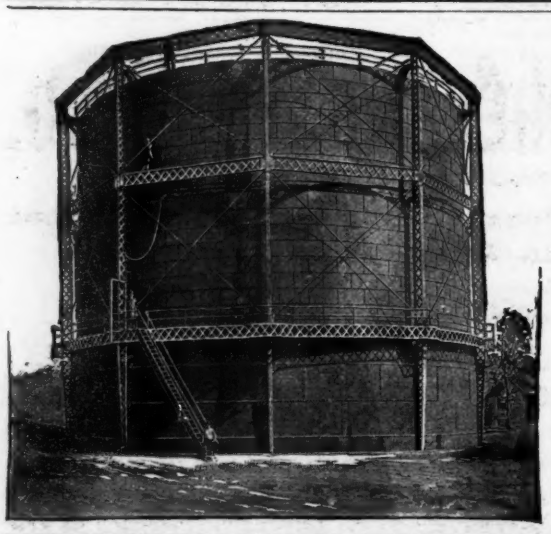

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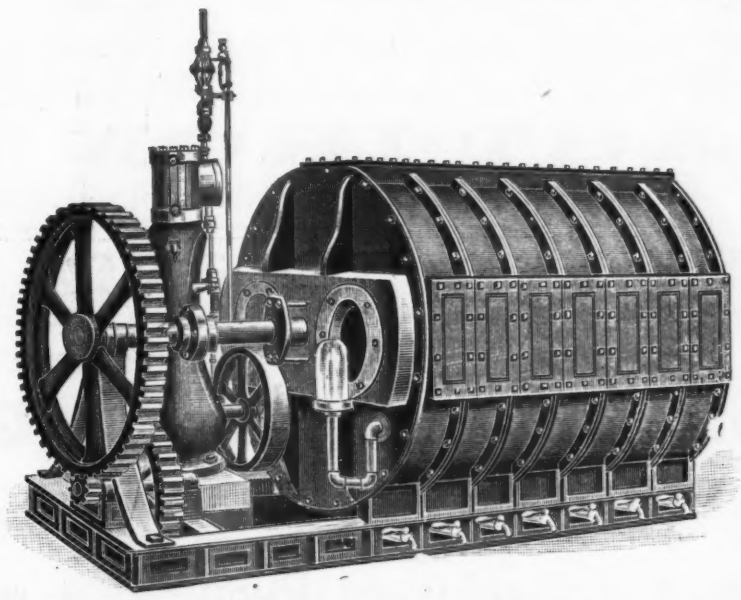

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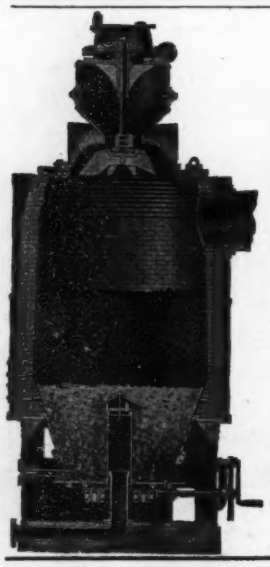

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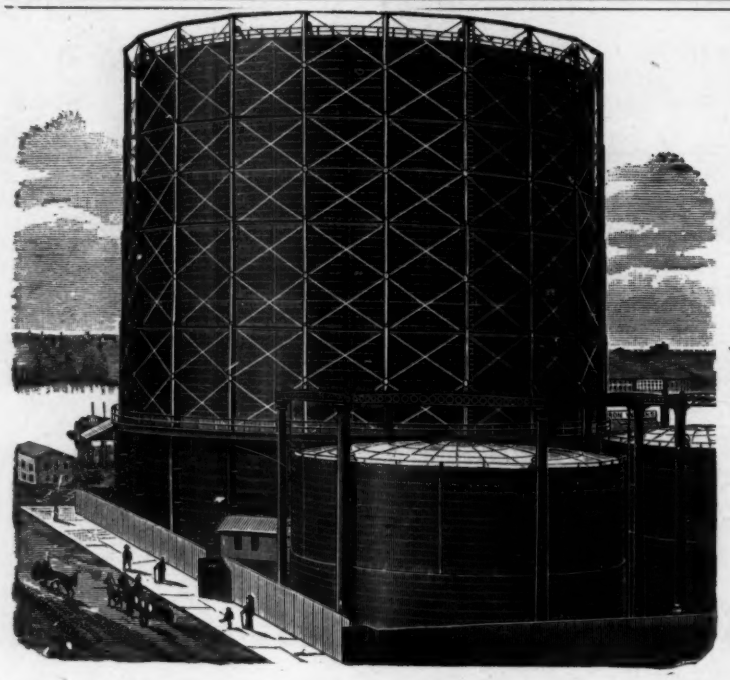

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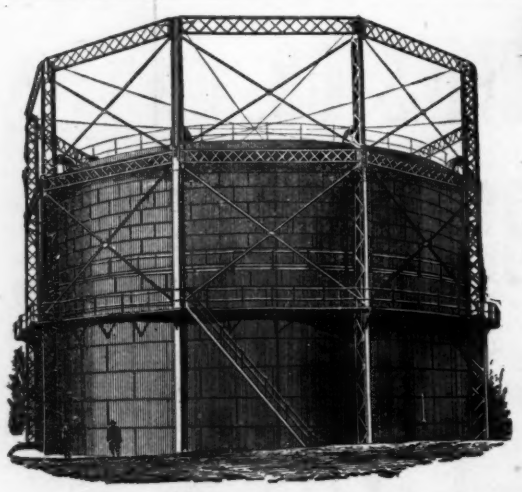

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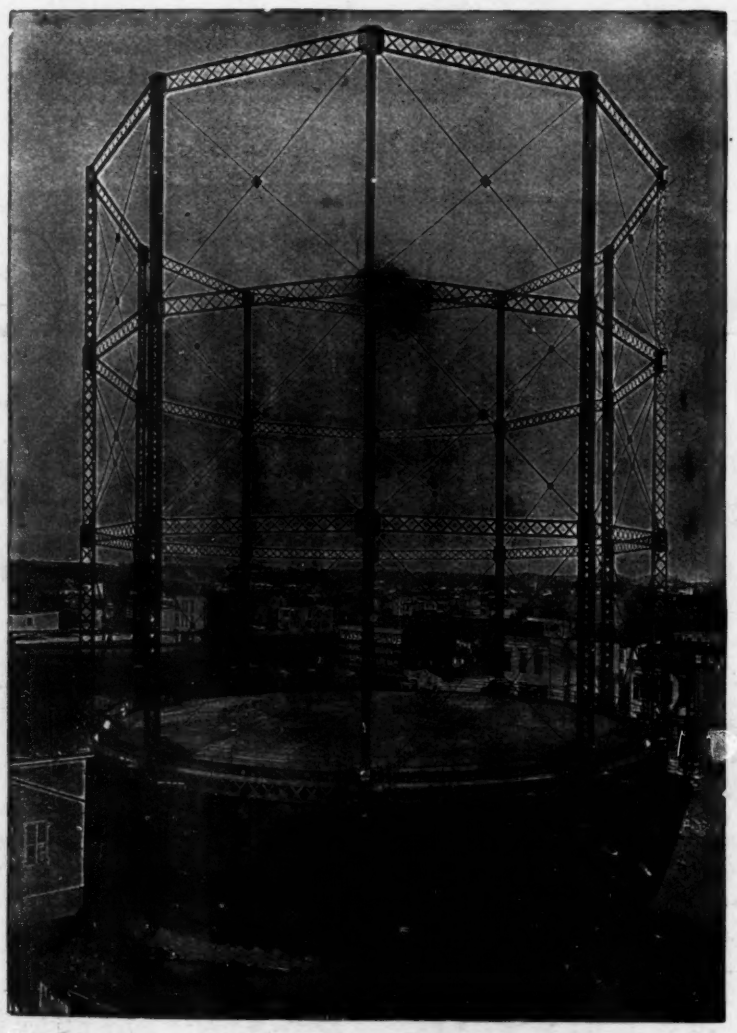

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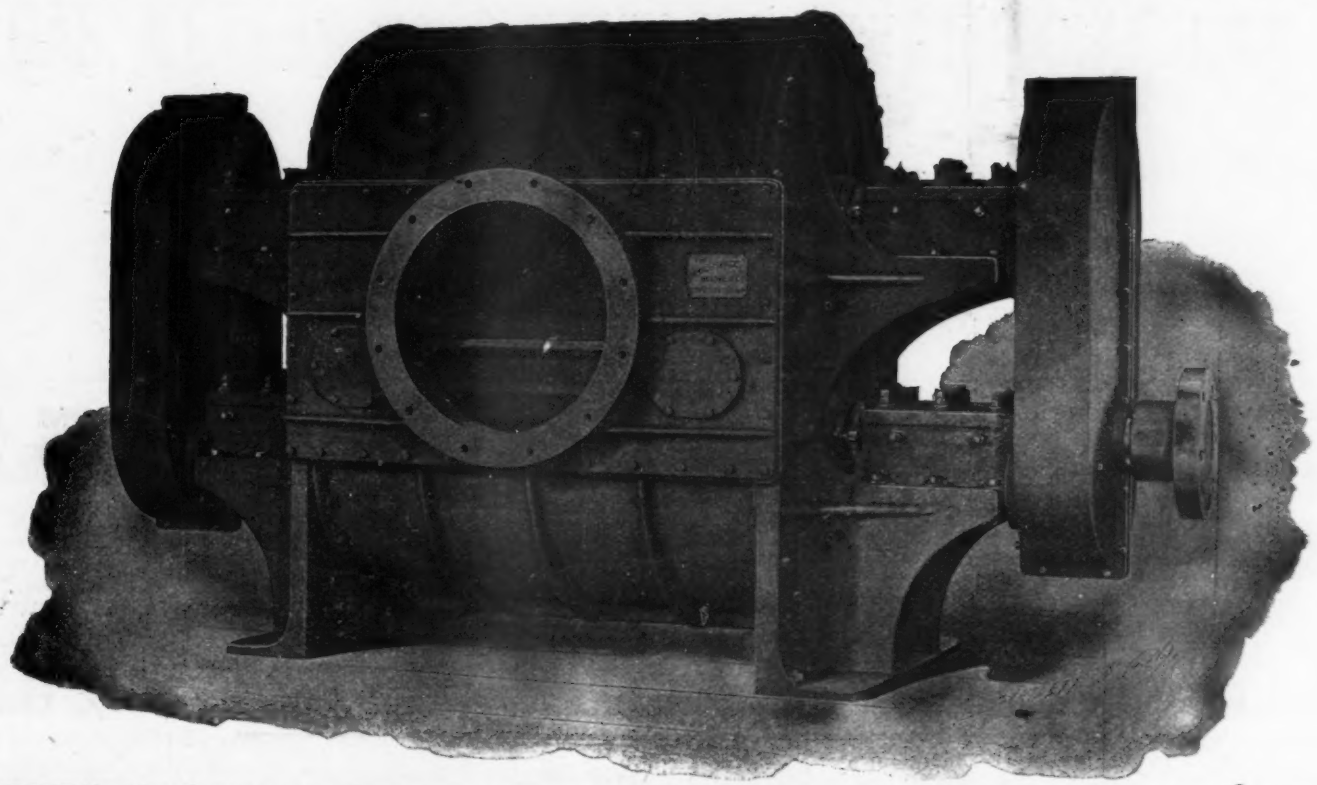

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